

AEJC
588
4-6-60

PRICING EFFICIENCY OF MARKETING BEEF CATTLE IN SOUTH FLORIDA

By
LOUIS VERNON DIXON

41605

A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL OF
THE UNIVERSITY OF FLORIDA
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY

D614p

UNIVERSITY OF FLORIDA

June, 1959

201.5.5

ACKNOWLEDGMENTS

At this point in the course of his education and experience the writer has been exposed to the thoughts and ideas of many individuals. Some readers may encounter passages or statements that resemble strikingly their own formulations. However, all readers should realize the impossibility of recognizing all persons upon whom the writer has drawn.

Special gratitude is due: W. K. McPherson, for his sincere friendship and his guidance of the dissertation through all of its phases; H. G. Hamilton, J. R. Greenman, R. H. Blodgett, and J. M. DeGrove, the writer's advisory committee, for their personal interest and constructive criticism; Rachel Schlichting for typing the preliminary drafts and drafting the illustrations; and Gerald Engelman, of the Agricultural Marketing Service.

Finally, the writer wishes to thank his wife and children, for their sacrifices and willingness to endure hardships during six long years of graduate study.

TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS	11
LIST OF TABLES.	v
LIST OF ILLUSTRATIONS	vii
 Chapter	
I. INTRODUCTION	1
The Situation and Problem	
The national situation	
Beef production in Florida	
Beef consumption in Florida	
The problem area	
Hypothesis and Plan of Study	
II. A CONCEPTUAL-PRICE FOR BEEF AND CATTLE IN THE MIAMI MARKETING AREA	19
III. THE NATURE OF COMPETITION FOR CATTLE IN THE MIAMI MARKETING AREA	33
Characteristics of the Marketing Situation	
Numbers of buyers and sellers	
Volume or size of firm	
Possession of knowledge	
Differentiation of product	
Evaluation of competition in the area	
IV. THE VALIDITY OF PRICE COMPARISONS.	45
Variation of Errors-of-Estimate in Grading Live Animals	
Review of literature	
Comparisons of errors-of-estimate among live- graders	
The effect of grading errors on price comparisons	

TABLE OF CONTENTS—Continued

V. PRICING EFFICIENCY IN THE MIAMI MARKETING AREA	Page 58
Byproduct Recovery	
Estimated Competitive Prices vs. Prices Reported	
F.O.B. Plant	
Prices of U. S. Choice grade	
Prices paid at the ranch	
Prices of U. S. Good grade	
Prices of other U. S. grades	
Prices Paid at the Belle Glade Auction	
VI. IMPLICATIONS	89
Economic Significance of Price Differences	
Problems Uncovered—Research Needed	
VII. SUMMARY, CONCLUSIONS, AND CONJECTURES.	95
APPENDIX.	100
BIBLIOGRAPHY.	125

LIST OF TABLES

Table	Page
1. Annual Average Retail Cost of the Market Basket of Farm Food Products, 1948-58.	2
2. Per Capita Meat Consumption, by Type of Meat, in Ten Selected Countries, 1957.	3
3. Estimates of Selected Segments of Production and Consumption of Beef and Veal in Florida and the United States, 1957.	7
4. An Index of Physical Efficiency in Production of Cattle and Calves 1948 and 1956, Per Cent Change in Total Live-weight Production, and Per Cent Change in the Index 1948 to 1956, by States Ranked According to Change in the Index	11
5. Percentages of Total Commercial Slaughter by Four Leading Meat Packers, by Classes of Livestock, for Selected Years, United States	20
6. Sales by Packer Branch Houses and Independent Wholesalers, 1954, and Percentage Changes in Sales by Regions, 1939-54	22
7. Arrays of Mean Errors-of-Estimate and Standard Deviations of Errors-of-Estimate, for Twenty-six Selected Live-Graders, on Selected Lots of Animals.	53
8. Live to Wholesale Price Spreads, U. S. Choice Grade Steers by Quarters, 1956-58	65
9. Differentials Between Selected Prices of Live Animals and Liveweight Equivalents of Estimated Competitive Prices for Carcasses, U. S. Choice Steers, August, 1957, to October, 1958	67
10. Comparison of Estimated Competitive Prices F.O.B. Plant Miami and Selected Prices Paid at Ranch Adjusted to Approximate F.O.B. Plant, for U. S. Choice Steers	72
11. Differentials Between Selected Prices of Live Animals and Liveweight Equivalents of Estimated Competitive Prices for Carcasses U. S. Good Steers, August, 1957 to December, 1958.	75

LIST OF TABLES—Continued

Table	Page
12. Combined Receipts of Slaughter Cattle and Calves at Thirteen Florida Auctions, Percentages by U. S. Grades, 1956.	79

Appendix Table

1. Analyses of Variance of the Actual Estimates and the Errors-of-Estimate, and the Associated Duncan's Test for 128 Steers, by Five Live-Graders.	107
2. Analysis of Variance of Errors-of-Estimate, and the Associated Duncan's Test, Among Five Graders, by Each of Eight Grades.	112
3. Analysis of Variance of Errors-of-Estimate and the Associated Duncan's Test, Among Five Graders, by Each of Six Breeds.	114
4. Analysis of Variance of Errors-of-Estimate, Among Eight Grades of Animals, by Five Live-Graders	117
5. Kramer's Extension of Duncan's Multiple Range Test of Significance Among the Mean Errors-of-Estimate for Eight Carcass Grades of 126 Steers, by Each of Four Graders . . .	118
6. Analyses of Variance of Errors-of-Estimate and Associated Duncan's Test, Among Six Breeds of Animals, for Two Live-Graders	121
7. Values of t from the Test of $\mu = 0$ Using the Mean Error-of-Estimate, by Each Grader, for All Animals in a Specified Carcass Grade	123

LIST OF ILLUSTRATIONS

Fig.		Page
1.	Density of Numbers of Cattle and Calves on Farms, by Counties, Florida, 1954, and Four General Livestock Marketing Areas.	5
2.	Liveweight Production of Cattle and Calves in Florida, 1940-57.	9
3.	Selected Marketing Channels for Beef Animals and Beef with Six Areas of Competition (Roman Numerals), and Five Levels of Price Discovery (Arabic Numbers), and Points of Sale (Arrowheads).	23
4.	Frequency Distributions of Errors-of-Estimate in Live-Grading, for Five Selected Live-Graders, on 128 Animals, by Thirds of U. S. Grades	51
5.	U. S. Choice Steers at Miami: Estimated Competitive Price F.O.B. Plant, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to March, 1959	64
6.	U. S. Good Steers at Miami: Estimated Competitive Price F.O.B. Plant and Market News Price Quotation F.O.B. Plant, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to March, 1959.	74
7.	U. S. Good Steers at Belle Glade: Direct Sale Prices F.O.B. Miami Adjusted to their Equivalent at Belle Glade, and Belle Glade Auction Prices, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to October, 1958	82
8.	U. S. Standard Steers at Belle Glade: Direct Sale Prices F.O.B. Miami Adjusted to their Equivalent at Belle Glade, and Belle Glade Auction Prices, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to October, 1958	84
9.	U. S. Utility Steers at Belle Glade: Direct Sale Prices F.O.B. Miami Adjusted to their Equivalent at Belle Glade, and Belle Glade Auction Prices, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to October, 1958	85

LIST OF ILLUSTRATIONS--Continued

Fig.	Page
10. U. S. Canner-Cutter Cows at Belle Glade: Direct Sale Prices F.O.B. Miami Adjusted to their Equivalent at Belle Glade, and Belle Glade Auction Prices, the Low of the Price Range Reported, in Dollars Per Live Hundred-weight, August, 1957, to October, 1958.	86

Appendix

Fig.	
1. A Symmetrical Distribution of Errors-of-Estimate by Thirds of U. S. Grades, for a Hypothetical Grader, with Theoretical Frequencies Derived by Fitting a Normal Curve to a Set of 119 Observations Having an Assumed Mean and Variance	105

CHAPTER I

INTRODUCTION

The Situation and Problem

The national situation.---Few would deny that in the United States today meat is given a prominent place in the diet. In terms of dollars, consumers spend more money for meat than for any other general category in the "market basket of farm foods" (Table 1). As their incomes rise, consumers tend to spend more for red meats, and particularly beef.¹ Livestock producers have responded to increases in consumer expenditures for meat by increasing the volume produced. In 1956 production of red meat reached a record of 28,053 million pounds, and civilian per capita consumption reached 166.7 pounds.² More than half of the 1956 production, or 16,094 pounds, was beef and veal.³

Although people in the United States do eat comparatively large quantities of meat, their consumption per capita is not the largest in the world. United States per capita meat consumption of 159 pounds in 1957 was exceeded by four other countries (Table 2). Consumption of

¹U. S. Department of Agriculture, "Consumption Patterns for Meat," AMS 249 (Washington: Government Printing Office, May, 1958), pp. 17-35.

²U. S. Department of Agriculture, The Livestock and Meat Situation, LMS-99 (Washington: Government Printing Office, November, 1958), p. 6.

³Ibid.

TABLE 1
ANNUAL AVERAGE RETAIL COST OF THE MARKET BASKET OF FARM FOOD PRODUCTS, 1948-58*

Year	Market Basket	Meat	Fruits and Vegetables	Dairy	Bakery and Cereal	Poultry and Eggs	Fats and Oils	Miscellaneous
1958	\$1064.43	\$292.02	\$233.67	\$194.04	\$159.84	\$ 96.50	\$44.90	\$43.46
1957	1007.41	259.15	218.72	191.35	156.69	93.92	45.36	42.23
1956	972.21	233.49	219.80	185.48	150.72	97.66	43.44	41.59
1955	974.93	246.67	208.12	181.21	150.00	104.72	42.88	41.33
1954	992.79	271.09	205.61	181.73	147.65	100.87	44.30	41.54
1953	1002.04	264.64	206.96	187.43	143.69	115.95	41.93	41.44
1952	1028.19	289.86	211.75	190.29	141.17	112.84	41.51	40.77
1951	1026.15	299.85	197.09	182.55	138.01	118.49	49.02	41.14
1950	924.31	265.06	185.48	162.65	126.90	104.03	42.33	37.86
1949	938.99	253.88	197.39	165.88	124.78	115.21	43.80	38.05
1948	993.60	278.88	194.16	178.25	125.60	121.68	56.56	38.47

*Source: U. S. Department of Agriculture, The Marketing and Transportation Situation (Washington: Government Printing Office, January, 1959, 1958, 1957, 1956, 1955, February, 1954, November, 1953 supplement).

TABLE 2

PER CAPITA MEAT CONSUMPTION, BY TYPE OF MEAT,
IN TEN SELECTED COUNTRIES, 1957^a

Country	Class of Meat				
	Total	Beef and Veal	Pork	Lamb and Mutton	Canned Meat
	(Pounds)	(Pounds)	(Pounds)	(Pounds)	(Pounds)
Argentina	242	210	19	13	b
Australia	223	129	16	74	4
New Zealand	220	112	31	76	b
Uruguay	168	130	12	26	b
United States	159	93	62	4	b
Denmark	142 ^c	54	87	d	b
Canada	137	84	45	3	5
United Kingdom	134	55	42	22	15
France	122 ^c	64	48	6	b
West Germany	107 ^c	39	66	1	b

^aSource: U. S. Dept. of Agriculture, Foreign Agricultural Circular, FLM 11-58 (Washington: Government Printing Office, October 31, 1958), p. 4.

^bIncluded with other types.

^cIncludes horsemeat.

^dLess than one-half pound.

meat and particularly beef in the United States might expand somewhat if meat and meat products were priced lower in relation to other foods.

Beef production in Florida.---Some cattle are produced in all sections of the state, but commercial production is concentrated largely in the central and southern areas (Fig. 1). The central and southern portions of Florida are part of a lower-lying coastal plain and are more like the sub-tropics.⁴ Most of the large expanses of native range land are situated within the lower half of the peninsula and here, on both improved and native pastures, cattle production is dominated by a cow-calf operation. Conditions in northeastern and northwestern Florida are more typical of the rolling coastal plains of Southeastern United States.⁵ Corn and other grain crops are better adapted to this area and many small dry lot feeding operations are found here as part of diversified farming.

Of course, cattle raising must compete with citrus and vegetable production, but as yet this is not a serious threat to the cattle industry. Florida producers contribute a large portion of the national supply of citrus and winter vegetables. Expansion of citrus groves and vegetable acreage is undertaken at a risk of creating oversupply and the accompanying lower prices. On the other hand, since beef production in the state represents only approximately 1 per cent of the national

⁴U. S. Department of Agriculture, Soil, The 1957 Yearbook of Agriculture (Washington: Government Printing Office, 1957), pp. 579-597.

⁵Ibid.

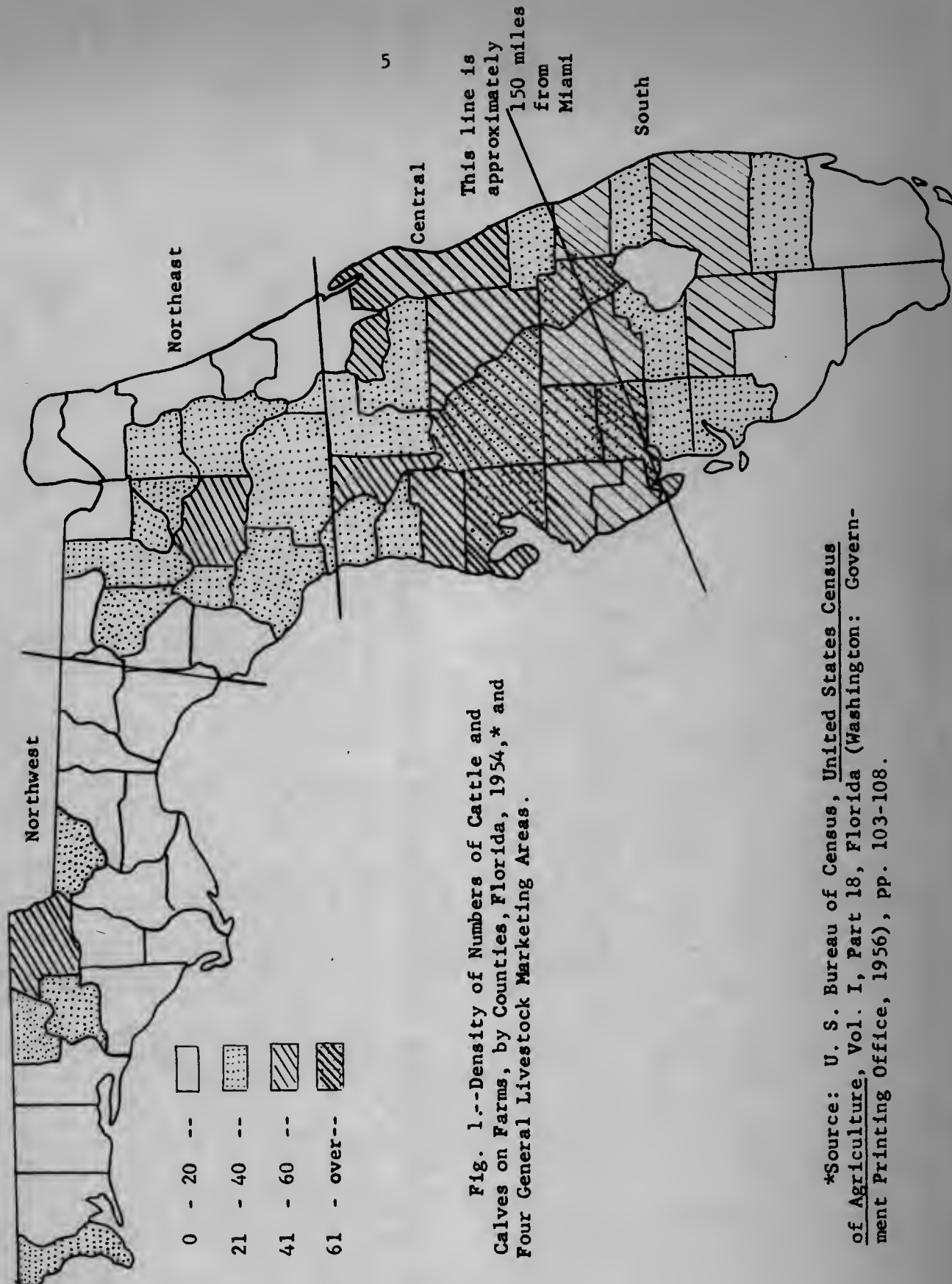


Fig. 1.--Density of Numbers of Cattle and Calves on Farms, by Counties, Florida, 1954,* and Four General Livestock Marketing Areas.

*Source: U. S. Bureau of Census, United States Census of Agriculture, Vol. I, Part 18, Florida (Washington: Government Printing Office, 1956), pp. 103-108.

supply (Table 3), producing more beef in Florida would have an imperceptible effect upon price.

Florida farmers and ranchers produced approximately 33½ million pounds liveweight of beef in 1957.⁶ This represented slightly more than 1 per cent of the national total of approximately 27,000 million pounds liveweight.⁷ Eighty-one per cent of the 1,934,000 cattle and calves on farms and ranches in Florida on January 1, 1958, were kept for other purposes than milk production.⁸ Since most dairy cattle eventually are slaughtered for meat, they too must be considered part of the beef potential.

Total liveweight production of cattle and calves in Florida has doubled since 1948 (Fig. 2). In the period 1948-58, beef cattle and calves on farms and ranches in Florida increased from 961,000 to 1,559,000 head, a gain of 62 per cent.⁹ These increases in production appear to be substantial, but, they do not necessarily mean increased efficiency.

The number of pounds of beef produced per animal on hand January 1 is one measure of physical efficiency in livestock produc-

⁶U. S. Department of Agriculture, Agricultural Marketing Service, Livestock and Meat Statistics, Statistical Bul. No. 230 (Washington: Government Printing Office, July, 1958), pp. 41, 283-289.

⁷Ibid.

⁸Ibid., p. 15.

⁹Florida State Marketing Bureau, Annual Agricultural Statistical Summary (Jacksonville 1, Florida: Florida State Marketing Bureau, November, 1957 and 1958), p. 159 (1957) and p. 170 (1958).

TABLE 3.—Continued

Meat Statistics, Statistical Bul. No. 230 (Washington: Government Printing Office, July, 1958), pp. 41 and 283-289.

^bSource: U. S. Department of Agriculture, Agricultural Marketing Service, Consumption Patterns for Meat, AMS-249 (Washington: Government Printing Office, May, 1958), p. 12.

^cJohn N. Webb, "Preliminary Estimates of the Population of Florida Counties: July 1, 1957," Bureau of Economic and Business Research Population Series Bul. No. 4 (Gainesville: University of Florida, January, 1958), p. 1 (mimeographed). Population in Florida, July 1, 1957, estimated at 4,238,200. Population multiplied by per capita consumption is an estimate of total consumption.

^dEstimate based on an average 47.3 per cent dress-out or yield. A weighted average yield was computed from the dress-out percentages obtained from a reliable packer for the several grades of cattle and calves, weighted by the proportions of the several grades sold at fourteen auctions in 1957.

^eLiveweight figures for Florida are official U.S.D.A. estimates, whereas carcass weight figures are not. Percentage based on carcass weights is only 1 per cent.

^fAbout half of the U. S. Utility grade and nearly all of the lower grades of cattle and calves are used for processed meat. The other half of U. S. Utility and all higher grades are sold as fresh meat. In 1956 80 per cent of U. S. beef production was in the fresh meat grades. These estimates are published in (1) U. S. Department of Agriculture, Marketing Margins for Beef (Washington: Government Printing Office, December, 1953), p. 9 and (2) U. S. Department of Agriculture, The Livestock and Meat Situation, LMS-94 (Washington: Government Printing Office, March, 1958), p. 1.

^gFlorida State Marketing Bureau, Annual Agricultural Statistical Summary, (Jacksonville: Florida State Marketing Bureau, November, 1958), pp. 176-177, 183. It is estimated that in Florida one-half of the Utility and all the lower grades would include 72 per cent of the slaughter cattle and 30 per cent of the slaughter calves. A weighted average of these two percentages, using live-weight volumes of commercial slaughter as weights, yields an estimated combined percentage of 64.7 in the grades sold for processing.

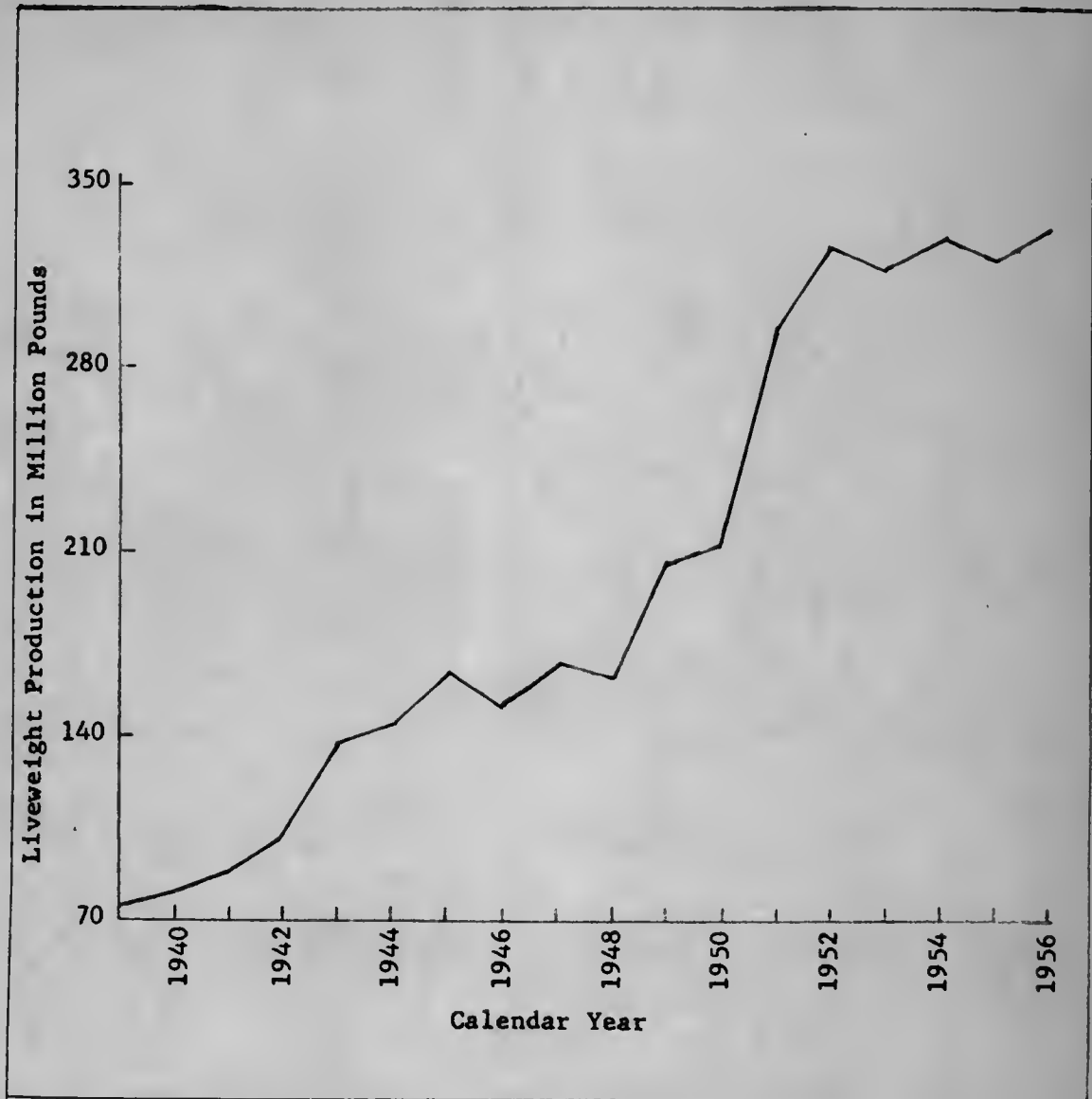


Fig. 2.--Liveweight Production^a of Cattle and Calves in Florida, 1940-57.^b

^aProduction equals weight of marketings and farm slaughter, less inshipments, plus or minus inventory changes during the year.

^bSource: U. S. Department of Agriculture, Meat Animals, Farm Production, Disposition, and Income 1924-57 (Washington: Government Printing Office, 1947 and annually).

tion.¹⁰ The ratio of the number of animals on hand to the amount of beef produced (in hundredweight) can be used as an index of production efficiency. The index is an input-output ratio relating total product to only one factor of production, the animal.¹¹ Since the number of animals is smaller than the number of pounds produced, the ratio will be less than one to one and the index expressed in terms of decimals. A small index indicates relatively high physical efficiency in beef production per unit of animal resource.

The index of beef production efficiency for the United States in 1948 was 0.42 (Table 4). Among forty-eight states the index ranged from 0.32 in Kansas to 0.83 in Rhode Island. Florida, with an index of 0.74, ranked forty-seventh. From 1948 to 1956 total liveweight production of beef in the United States increased 51 per cent (Table 4). In the same period the index of production decreased from 0.42 to 0.35, indicating an average 17 per cent gain in physical efficiency at the national level.

Total liveweight beef production in Florida by 1956 had increased 100 per cent from 1948 (Table 4). Along with Florida, the

¹⁰W. K. McPherson, "Initial Results of Livestock Marketing Study," The Florida Cattleman (Kissimmee, Florida: Cody Publications, Inc., September, 1952). This approach considers the number of cattle and calves on hand on any January 1 as the source from which that year's production must come.

¹¹Alternative measures of physical efficiency could be expressed in terms of other resources, such as feed per pound of gain. Some of the factors that influence the index are discussed in a succeeding paragraph.

TABLE 4

AN INDEX OF PHYSICAL EFFICIENCY IN PRODUCTION OF CATTLE AND CALVES
1948 AND 1956,^a PER CENT CHANGE IN TOTAL LIVELWEIGHT PRODUCTION, AND
PER CENT CHANGE IN THE INDEX 1948 TO 1956, BY STATES
RANKED ACCORDING TO CHANGE IN THE INDEX^b

State	Index of Production 1948	Index of Production 1956	Per Cent Change in Total Liveweight Production 1948-56	Per Cent Change in Index 1948-1956	State	Index of Production 1948	Index of Production 1956	Per Cent Change in Total Liveweight Production 1948-56	Per Cent Change in Index 1948-1956
Ohio	.59	.38	38	36	Mont.	.34	.30	52	12
Texas	.48	.34	39	29	Colo.	.34	.30	28	12
FLA.	.74	.54	100	27	S. D.	.36	.32	40	12
Miss.	.63	.46	126	27	Del.	.56	.49	29	12
Ga.	.66	.49	95	26	Ark.	.46	.41	70	11
Va.	.55	.41	76	26	Idaho	.37	.33	72	11
La.	.62	.47	103	24	Wisc.	.51	.46	28	10
Ill.	.37	.28	76	24	Conn.	.60	.54	12	10
Neb.	.35	.27	59	23	N. H.	.61	.55	11	10
Ariz.	.47	.37	50	22	N. M.	.40	.36	21	10
Iowa	.34	.27	64	21	Utah	.42	.38	50	10
Ala.	.53	.42	100	21	Tenn.	.48	.44	36	8
Minn.	.41	.33	53	20	N. J.	.53	.49	29	8
S. C.	.66	.53	119	20	Vt.	.73	.68	19	7
Ind.	.38	.31	56	18	Me.	.60	.56	12	7
Md.	.56	.46	53	18	W. Va.	.51	.48	15	6
Okla.	.36	.30	55	17	Wyo.	.34	.32	15	6
Kan.	.32	.27	50	16	Ore.	.39	.37	50	6
N. C.	.64	.54	71	16	Ky.	.41	.39	25	5
Wash.	.43	.36	68	16	N. Y.	.59	.57	14	4
Mich.	.48	.41	29	15	Mass.	.63	.62	- 2	2
N. D.	.38	.33	50	14	Nev.	.41	.40	21	2
Mo.	.37	.32	58	14	R. I.	.83	.88	-12	- 6
Cal.	.37	.32	00	14	Pa.	.46	.51	16	- 10
					U. S.	.42	.35	51	17

^aIndex: Number of Cattle and Calves on hand January 1, per one hundred pounds annual total liveweight production.

^bSource: U. S. Department of Agriculture, Meat Animals: Farm Production, Disposition, and Income, by States (Washington: Government Printing Office, July, 1952, and April, 1957).

other Southern states of Louisiana, Mississippi, Alabama, Georgia, and South Carolina exhibited large increases in liveweight production during this period. The index of production for Florida in 1956, 0.54, showed a 27 per cent gain in physical efficiency from that in 1948.

There can be several reasons for differences among the forty-eight states in average production per animal. Grass fed cattle may gain less than grain fed cattle. Feeder cattle and calves having different grade potentials are likely to vary in the rate at which they gain, or in their total gain during a specified period of feeding. The several breeds may respond differently to various types of feed. In some states animals are marketed at comparatively young ages, while in others the animals marketed are more mature. The proportion of calves marketed to cattle marketed varies from state to state. The weights of dairy cattle sold for slaughter may be somewhat different from weights attained by beef animals. In a dairy cattle state, compared with a beef cattle state, the number of animals slaughtered is likely to be a smaller percentage of the total number on hand. These and a host of other factors will affect the magnitude of the index of production expressed above.

Changes in the indices summarize the accomplishments made in beef production in recent years. But, since the index measures physical production, it cannot be used to compare the economic efficiency¹² of the cattle industries in the several states or regions. To date,

¹²E. O. Heady, Economics of Agricultural Production and Resource Use (New York City: Prentice-Hall, Inc., 1952), pp. 90-104.

research in the economics of beef production has not produced enough input-output data to describe the many production surfaces needed to quantitatively evaluate the efficiency of beef production.

Beef consumption in Florida.—The population in Florida has grown steadily to over four million people.¹³ This is a sizeable base for potential beef consumption. The 1955 per capita consumption data have been used to estimate beef and veal consumption in Florida for 1957 at approximately 395 million pounds (Table 3).¹⁴ Of this 395 million pounds, approximately 80 per cent was purchased as or prepared from fresh cuts of meat and the remaining 20 per cent was consumed as processed meat. Consumption of 395 million pounds represents only 2-1/2 per cent of the national total. Thus, changes in the consumption pattern for the state would have an insignificant effect upon national price.

Compared with state production estimates, the consumption of fresh meat far exceeds the locally-produced supply. On the other hand, the supply of locally-produced meat for processing is more than sufficient to satisfy this portion of meat consumption. Thus, the consumption-production balance for the state exhibits both surplus and deficit (Table 3).

The problem area.—Development of a surplus of one kind of beef and a deficit of another has been particularly rapid in South

¹³John N. Webb, op. cit.

¹⁴U. S. Department of Agriculture, "Consumption Patterns for Meat," AMS 249 (Washington: Government Printing Office, May, 1958).

Florida. Much of Central and Southern Florida enjoys an enviable position in the production of grass. Cattle production provides an effective means of marketing the forage, but the particular combination of resources has in the past encouraged production of lower grade cattle.¹⁵

Few other areas in the United States have the unique combination of climate, soil profile, level topography, and abundant water supply that is found in this section of Florida. These factors have permitted the development of two-way water control: irrigation and drainage on the same piece of land, both using open ditches to manipulate the water table.¹⁶ With respect to production of forage grasses, it appears South Florida can claim some comparative advantage.

Many of the same resources and geographical features that provide a favorable environment for the cattle industry have produced a distinct pattern of urban development. The coastal areas have tended to become thickly populated, and the interior, except for isolated spots, is only sparsely inhabited. A large area of consumption has built up along the lower east coast of the peninsula in the three southernmost counties of Palm Beach, Broward, and Dade. The total population in these three

¹⁵Use of the term "lower grade" is common in the livestock industry. It refers to the quality of meat not usually sold for consumption as fresh cuts. The U. S. grades of beef and beef animals in which this quality of meat is found are Utility, Canner, and Cutter. In contrast the term "higher grade" refers to U. S. grades Standard, Good, Choice, and Prime.

¹⁶Water is pumped out of or into a network of large dual-purpose feeder-drainage canals. The canals are part of a flood control program administered by the Central and Southern Florida Flood Control District, whose jurisdiction embraces 15,570 square miles.

counties as of July 1, 1957, was estimated at 1,269,000.¹⁷

On the basis of 1955 per capita consumption, 1,269,600 people in the tri-county area would consume annually an estimated 116,800,000 pounds of beef and veal.¹⁸ Of this, approximately 80 per cent or 93,000,000 pounds would be fresh non-processed meat (Table 3, footnote f). Production in Florida of beef and veal for fresh meat consumption is estimated for 1957 at 55,781,820 pounds (Table 3). This quantity cannot fill even the lower east coast consumption requirement.

The counties within a radius of 100-150 miles from Miami contain some of the most dense cattle populations in the state (Fig. 1). However, these cattle are marketed largely as grass-fed animals. Although some producers strive to put a degree of finish on their cattle, the bulk of the marketings to slaughterers are lower grade animals generally used in the manufacture of processed meat products. Very little lower grade beef is demanded by the fresh meat trade, so in this respect the local supply far exceeds the demand (Table 3). Low grade cattle must be absorbed by meat processors, but here a large supply of animals or beef must be shipped long distances to eastern markets. On the other hand,

¹⁷John N. Webb, op. cit.

¹⁸U.S.D.A., "Consumption Patterns for Meat," op. cit. Because of the pattern of migration and tourism from northern industrial areas to the lower east coast of Florida, meat-eating habits of people in the lower east coast area are more likely to be those of people living in the urban Northeastern United States. In 1955 annual beef and veal consumption in the urban northeast was estimated at approximately 92 pounds per capita. At 92 pounds per capita annual consumption for 1,269,600 people would total 116,800,000 pounds.

the supply of locally produced higher grade beef animals is short of the demand (Table 3). To fill their needs the packers and wholesalers must ship in fresh meat from surplus-producing areas such as the Midwest.

The problem.--Packing plants in Miami are the main outlets for slaughter animals produced in South Florida. Unlike the midwest cities with major livestock markets, there is no appreciable outshipment of fresh beef from Miami.¹⁹ This indicates that virtually all higher grade beef animals slaughtered in Miami are consumed there.

Among cattlemen in South Florida is the general opinion or belief that they do not receive equitable prices for cattle which they estimate to be in grades sold for fresh meat consumption.²⁰ Ideas of what constitute equitable prices are extremely varied. However with a wide dissemination of prices prevailing at various marketing centers today, producers are likely to think of equity in terms of how prices they receive compare with prices quoted elsewhere.²¹

In our society equitability of price is judged subjectively and evaluated within the framework of existing institutions. Undoubtedly

¹⁹Boned meat and occasionally some lower grade carcasses and cuts are shipped out-of-state, particularly to the Northeast.

²⁰Webster's New Collegiate Dictionary, 1953 edition, defines opinion as implying having been thought out, yet open to dispute. Belief implies acceptance and intellectual assent.

²¹Practically every generation of farmers has voiced an opinion that they were not receiving equitable prices for their products. Cf. H. G. Halcrow, Agricultural Policy of the United States (New York: Prentice-Hall, Inc., 1953), pp. 215-234, and H. F. Williamson (ed.), The Growth of the American Economy (New York: Prentice-Hall, Inc., 1946).

there is disagreement among producers as to what constitutes an equitable price. Nevertheless, the premise of a competitive price constituting the ultimate in equity is generally accepted.

Assuming a purely competitive price as a standard of equity, the problem then becomes one of estimating to what extent cattle prices in Miami deviate from the standard. The geographical isolation of a meat consumption center at the tip of a peninsula, bordered and insulated by an area producing a surplus of lower grade beef animals, provides an ideal situation in which to observe the effects of location on the prices of higher grade beef animals. The tendency toward beef price equalization in space should be easier to detect in the Miami market where competing products flow in from only one direction, the North.

Hypothesis and Plan of Study

The broad objective of this dissertation is to evaluate the assertion that in South Florida prices paid for higher grade cattle are unequitable.²² In general, the analysis will appraise the relative pricing efficiency of marketing slaughter cattle in the well-defined more or less homogeneous production area of South Florida. More specifically, the hypothesis to be tested is that prices of higher grade slaughter cattle sold into the greater Miami area are lower than would

²²The evaluation of matters of opinion is a legitimate role for economic analysis. Cf. Geoffrey Shepherd, "What Can a Research Man Do in Agricultural Price Policy?", *JFE*, May, 1955, pp. 305-14. "A person's belief. . . can be objectively judged to be true or false and more or less complete. . . The essence of scientific inquiry is to test (verify or disprove) beliefs."

be expected in a competitive marketing situation. This approach provides the latitude for a useful analysis, and at the same time restricts the area of inquiry enough so that results are probable within a reasonable period of time.

The method used to test the hypothesis will be to:

- (1) develop a conceptual-price or competitive price model for beef carcasses and live cattle sold in the Miami market area;²³
- (2) describe the nature of competition for cattle in the Miami market;
- (3) compare the conceptual-prices with prices received by cattle producers
 - (a) at the packing plant, F.O.B.,
 - (b) at the auction,
 - (c) at the farm or ranch.

²³Unfortunately there is no wholesale meat price quotation available publicly for any market in the Southeast. Such a quotation would be of immeasurable value to cattlemen and persons in agricultural research and extension work who strive to keep informed on prices in their respective areas.

CHAPTER II

A CONCEPTUAL PRICE FOR BEEF AND CATTLE IN THE MIAMI MARKETING AREA

The market for meat and livestock is nationwide and is composed of many geographical marketing areas. Except for requirements pertaining to sanitation and health, there are no interstate trade barriers to free movement of meat animals and meat. Thus the forces of supply and demand functioning through modern facilities for training continually adjust the flow of products in a manner tending towards a balance among marketing areas.

Facilities for trading meat were revolutionized in the perfection of food preservation by freezing, and the development of freezer railroad cars and motor trucks. With an extensive system of communication, market news reports of trading in animals and meat are distributed over the entire country. Instantaneous communication between buyer and seller separated by great distances is now a reality. An isolated marketing area of any consequence is virtually a thing of the past.

Competition in the market for livestock and meat varies from the empirical approximation of pure competition among cattle producers to the oligopsonistic-oligopolistic position of packers. However, concentration in the meat packing industry today is less than at any time during the past fifty years (Table 5). Sales by independent wholesalers in the United States increased 108 per cent from 1939-54, compared with

TABLE 5

PERCENTAGES OF TOTAL COMMERCIAL SLAUGHTER BY
FOUR LEADING MEAT PACKERS, BY CLASSES OF
LIVESTOCK, FOR SELECTED YEARS,
UNITED STATES^a

Year	Cattle	Calves	Sheep and Lambs	Hogs
1916	53.9	32.1	70.2	51.2
1924	50.5	40.1	66.4	44.7
1929	49.9	46.9	70.7	40.2
1935	46.6	46.3	70.5	41.4
1947	38.3	39.6	67.8	40.4
1955	30.8	34.7	58.5	36.4

^aSource: W. F. Williams, "Structural Changes in the Meat Wholesaling Industry," JFE, May, 1958, p. 319.

a 5.5 per cent decrease for packer branch houses (Table 6).

The meat wholesaling industry is comprised of many types of firms.²⁴ Modern integrated packing plants not only slaughter animals, but are equipped with adequate cold storage facilities and provide distribution services to their customers. Many of them sell boned beef and manufacture processed meats. Some may also break higher grade carcasses into primal cuts for sale to retailers or into cuts demanded by hotels and restaurants. Packers may operate branch houses in several cities. In providing these many services the packer functions as a wholesaler (Fig. 3).

Chain store organizations buy carcasses or primal cuts in large volume and provide storage, wholesaling, and distribution services for member stores. In doing so they may buy carcasses directly from local slaughterers or compete actively with other buyers in the major wholesale markets for carcasses and primal cuts (Fig. 3).

The firms engaged primarily in wholesaling activities usually have some cold storage space, and prepare the particular cuts of meat for their specified trade. Such firms are known in the trade as independent wholesalers or jobbers (Fig. 3). Among these are "hotel supply houses," "institutional jobbers," "truck jobbers," "breakers," "fabricators," and "retail supply houses."²⁵ Firms that buy carcasses

²⁴Willard F. Williams, Wholesale Meat Distribution in the San Francisco Bay Area, U. S. Department of Agriculture Marketing Research Report No. 165 (Washington: Government Printing Office, 1957), pp. 7-12.

²⁵Ibid.

TABLE 6

SALES BY PACKER BRANCH HOUSES AND INDEPENDENT WHOLESALERS,
1954, AND PERCENTAGE CHANGES IN SALES BY REGIONS,
1939-54^a

Wholesale Distributor and Region	1954 Sales	Percentage Change ^b		
		1939-48	1948-54	1939-54
	1,000 (dollars)			
<u>Packinghouse Branches:</u>				
Northeast	1,098,209	-29.9	14.8	-19.6
North Central	500,989	-23.0	9.2	-15.9
South	874,527	-4.4	25.1	19.6
West	223,758	12.2	22.1	37.0
United States	2,697,483	-19.5	17.4	-5.5
<u>Independent Wholesalers:</u>				
Northeast	1,359,289	23.9	54.0	90.8
North Central	690,356	6.3	82.4	93.9
South	425,127	33.0	119.1	191.3
West	391,421	24.2	92.5	139.1
United States	2,866,193	20.3	72.8	108.0

^aSource: W. F. Williams et al., Economic Effects of U. S. Grades for Beef, U. S. Dept. of Agriculture Marketing Research Report No. 298 (Washington: Government Printing Office, 1959), p. 28.

^bAll sales adjusted to 1954 levels of price, prior to calculation of percentages.

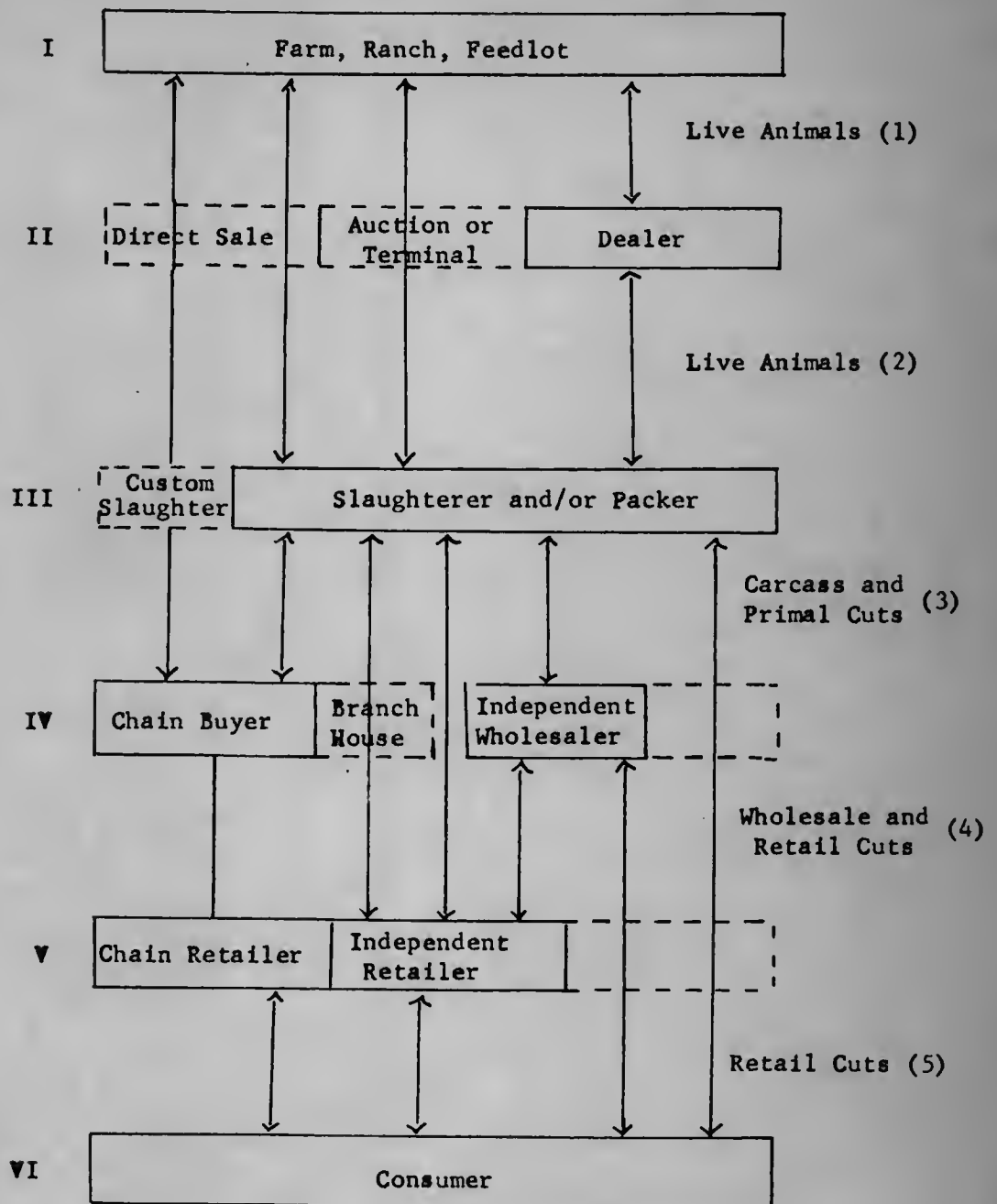


Fig. 3.--Selected Marketing Channels for Beef Animals and Beef, with Six Areas of Competition (Roman Numerals), and Five Levels of Price Discovery (Arabic Numbers), and Points of Sale (Arrowheads).

of cows and other lower grade beef animals and bone the meat are called "boners." Still other firms buy carcasses and prepare a variety of frozen meat products. They sell primarily to independent retailers or independent grocery distributors.²⁶

In addition to the specialized types of activities of firms described above, some marketing is carried on by vertically integrating two or more of these specialized operations. For example, a chain store organization may contract with a feedlot to have animals fed, then custom slaughtered and have the carcasses delivered directly to their cold storage plant (Fig. 3). Packers may contract to have animals fed to grade, or contract with wholesale buyers for definite quantities and grades of carcasses at specified times of delivery. The net effect of these arrangements alters the price discovery mechanism by removing some of the uncertainty element for the parties involved. At the same time it reduces the number of traders who are active participants in the areas of competition (Fig. 3).

Under conditions of pure competition, differences between prices of specific forms of products in surplus and deficit areas tend to equalize in space and time to the extent of differences in transfer costs between the areas and the costs of storage from one period to another.²⁷ However, this tendency towards equalization is not limited to conditions of pure competition.

²⁶Ibid.

²⁷G. S. Shepherd, Marketing Farm Products (Ames, Iowa: Iowa State College Press, 1947), pp. 339-410.

From the standpoint of numbers of buyers and sellers, and size of firm, competition in a marketing situation might be considered imperfect. But, if other conditions of pure competition are approximated reasonably well, the tendency towards equalization of price will not be hindered. The tendency towards price equalization depends heavily upon the characteristics of the product and facilities for trading:

... nearly all those things for which there is a very wide market are in universal demand, and capable of being easily and exactly described ... commodities ... must be such as will bear a long carriage: they must be somewhat durable ...²⁸

In the meat industry today, numbers of buyers and sellers and size of firm are characteristic of imperfect competition. The prices discovered for livestock and meat very likely are different from those expected under more highly competitive conditions. But other marketing conditions in the industry are such that spatial and temporal equalization in price can occur. There is voluminous market information circulated by a rapid communications system. There are no trade barriers to the movement of meat and animals over a modern system of railroads and highways. Meat and animals can be graded, transported, and stored.

Meat packers have been under close scrutiny by the Federal Trade Commission since the early 1900s, and there has been evidence of market sharing among the major firms. However, no evidence has been presented to indicate that meat packers use a basing-point price

²⁸ Alfred Marshall, Principles of Economics (8th ed., New York: The MacMillan Co., 1921), pp. 325-26.

system charging false freight. On the contrary, chain store buyers purchase carcasses from packers in the major trading centers at prices F.O.B. the slaughter plant. Apparently then, no attempt is made to interfere with the tendency of prices of specific products to equalize in space and time.

Both livestock and meat may be transported and stored. But over long distances, the freight rate structure makes it more profitable to ship meat instead of live animals.²⁹ In addition to the freight rate, other transfer costs are encountered with shipping livestock. For example, the costs of feeding and watering, weight shrinkage, and losses from deaths and crippling must be considered. Slaughter cattle are shipped long distances from surplus to deficit areas only when a temporary marketing phenomenon brings about an abnormally high price of meat in the deficit area or an abnormally low price of cattle in the surplus area. Since meat is transported more easily and at lower cost than cattle, the prices of carcasses and cuts are more likely to reflect the spatial equalization between surplus and deficit areas.

In any geographical area where marketing is concentrated, such as Miami, the wholesale prices of meat are discovered at two levels of trading. First, there is the wholesale selling price at

²⁹In May, 1957, the freight rate per hundredweight from Chicago to Miami was \$2.03 for meat and \$1.49 for livestock. If a live steer shipped from Chicago yielded 58 per cent, the freight cost of shipping the carcass in form of a live animal would have been \$2.57, or 54 cents more than for dressed carcasses.

which firms providing wholesaling services sell to retailers and eating establishments (level 4, Fig. 3). Secondly, there is the wholesale buying price at which wholesalers and chain stores buy or at which slaughterers and packers sell (level 3, Fig. 3).

The wholesale selling price will differ from the wholesale buying price by the value of the type of wholesaling services provided by the wholesale firm or branch house. However, today with independent packers and chain stores performing more and more of the wholesaling services for themselves, the wholesale-selling price (level 4, Fig. 3) is becoming less discernible.³⁰ Since chain stores handle a considerable portion of the fresh beef sold in urban areas, the wholesale selling prices that could be identified in an area like Miami would represent a minor portion of the total volume traded.³¹ Therefore, in the analysis that follows, the wholesale selling price is not examined.

Because traders in all parts of the country are in such close communication with each other, the level of wholesale meat prices is national in character. The national and large regional chain stores and national packers have their own price reporting services in addition to public market news reports. Some traders use teletype and leased-wire services. Practically all buyers and sellers make ex-

³⁰Competition from independent packers at the wholesale selling level plus chain store buying practices has forced the abandonment of many national packer branch houses in Florida.

³¹The percentage of meat sold by chains varies among regions and cities, but no recent estimates are available. In 1948, chains in the U. S., with five or more stores, sold 35 per cent of the meat. Since then, this percentage is almost certain to have increased.

tensive use of the telephone. In any one area prices at the wholesale buying level can get out of line with the national situation only temporarily. The competitive adjustment in meat prices between surplus and deficit areas occurs most directly at the wholesale buying level.

In the smaller as well as the larger marketing areas local packers who produce and sell carcasses and cuts to chain stores and other wholesale buyers compete directly with supplies available from other areas. As a seller, the local packer competes with not only other local packers but national and regional packer branch houses serving the area, and with more distant sources of supply available to wholesale buyers. As a buyer of cattle, the local packer often is one of only several buyers in an area. When an individual firm contemplates a change in pricing policy, it is somewhat easier to anticipate the reaction of a few rather than many competitors. With only a few competitors an individual firm probably can learn from experience to anticipate competitors' reactions quite accurately. In this respect, the market into which packers sell meat is more competitive than the market in which they buy animals. Price changes in the national market for meat will be reflected back quickly to the livestock producers in any particular area only if a high degree of competition exists among the livestock buyers in the area.

The conceptual price.—Florida is deficit in the production of higher grades of beef (Table 3). To meet retail demand the chain

stores, meat packers, and other wholesale traders must turn to out-of-state supplies. The general areas where fed cattle are produced in large numbers are located at great distances from Miami and all of Florida.³² Thus, wholesalers must pay transfer costs in obtaining the fresh-meat grades of beef from the western surplus areas. These transfer costs include brokerage fees, and service and handling charges, in addition to transportation charges.

Miami packers operating their own slaughtering and cold storage facilities can either purchase carcasses from surplus areas or produce them in their plants.³³ Packers can calculate readily the total cost of carcasses purchased from surplus areas. This total cost is the wholesale buying price referred to previously. Under varying degrees of competition in the market, the wholesale buying price in a deficit area tends to equal the price in the surplus area plus costs of transfer to the deficit area. This relationship is expressed in equation (1) as:

$$(1) P_w = P_s + T_d$$

where P_w is the competitive wholesale buying price; P_s is the price in the surplus area; and T_d is the transfer costs from surplus to

³²The thirteen major states from which the U.S.D.A. reports cattle and calves on feed are Ohio, Indiana, Illinois, Minnesota, Iowa, Missouri, South Dakota, Nebraska, Kansas, Texas, Colorado, Arizona, and California.

³³The conceptual price is presented as applying to beef carcasses in full realization that trading in the wholesale market also concerns primal cuts or wholesale cuts of beef. It was not considered desirable to synthesize a carcass price from a composite of prices of primal cuts.

deficit area. For lack of a better estimate of transfer costs the freight rate from Chicago to Miami is substituted into the equation to estimate the competitive wholesale buying price of carcasses in Miami.³⁴

Packers producing carcasses in their plants incur costs of production, but the value of byproducts from the slaughtering operation partially or completely offsets these costs (including returns to all factors.)³⁵ If the byproduct value covered the packer's costs and returns, local suppliers of cattle delivered to Miami packing plants would expect to receive a price F.O.B. plant (either carcass grade and weight or its liveweight equivalent) equal to the competitive whole-sale-buying price. If packers costs exceed byproduct value, the price F.O.B. plant would be smaller by that amount. If byproduct value increased while costs and returns were unchanged, the price F.O.B. plant would be larger by that amount. Therefore, the price model or conceptual price paid F.O.B. plant for livestock purchased on a

³⁴Florida packers assert that their pricing policies are guided by the wholesale prices of carcasses and cuts quoted in the National Provisioner Chicago daily trade report, plus transportation charges from Chicago to their plants.

³⁵A unique example of a short-term loss operation has developed recently in Florida as a consequence of cattle being withheld from the market to build up herds. Packers found themselves with crews of workers highly trained to handle their kill floors, but forced to operate below profitable capacities because of a shortage of animals. Rather than terminate the employment of the skilled workers, packers have retained their crews, presumably at a loss and at the same time have bid up the prices of cattle in short supply in an attempt to maintain volume even at some loss.

carcass grade and weight basis is defined as:

The competitive wholesale-buying price, adjusted for the net difference between the value of byproducts and the plant cost of producing a dressed carcass from a live animal.

Expressed in symbols the conceptual price may be written as in equation (2):

$$(2) CP_p = P_w - S + B$$

where CP_p is the conceptual price per unit at the plant; P_w is the competitive wholesale-buying price per unit of carcass; S is the cost of slaughtering and dressing per unit of carcass; and B is the byproduct value per unit of carcass.

Equation (2) is expressed in units of carcasses. The conceptual price for live animals or the liveweight equivalent of the carcass price is obtained from the multiplication together of the conceptual carcass price and the estimated dressing percentage or yield of live animals, as in equation (3):

$$(3) LCP_p = (CP_p) \frac{\text{Dressing Percentage}}{100}$$

The conceptual price for animals sold with the point of delivery at the ranch is obtained easily by subtracting transfer costs for live animals from the price at the plant, as in equation (4):

$$(4) LCP_r = LCP_p - LT$$

where LCP_r is the liveweight unit conceptual price at the ranch, LCP_p is as defined in equation (3) and LT is the liveweight unit cost of transferring animals from the ranch to the plant. Transfer costs include a loading and unloading charge, and handling (such as feed

and water), in addition to transportation. Similar calculations may be made to estimate the conceptual price at an auction.

Whether or not the conceptual-price in a deficit area is paid for cattle depends upon the nature of competition among packing plants, and upon the selling practices of cattle producers. In Chapter III the degree of competition among plants in Miami will be evaluated.

CHAPTER III

THE NATURE OF COMPETITION FOR CATTLE IN THE MIAMI MARKETING AREA

Characteristics of the Marketing Situation

Conditions observed in any marketing situation really defy meaningful description unless they can be expressed in terms of some specified standard or form.³⁶ The scale or yardstick of competition ranges between perfect monopoly at one end and perfect competition on the other.³⁷ Use of the competitive model is solely for the purpose of estimating at what point along the scale of competition the market pricing observed in an area seems to lie.

To qualify under the concepts of pure competition, a marketing situation must approximate six general requisites:³⁸

- (1) The number of buyers and sellers must be so large that the activities of any single individual cannot affect the market price.

³⁶By referring to a pre-determined model, the analyst can guide his observations in an organized manner, thus concentrating on those things that are important for his purpose and not wasting time on irrelevant material.

³⁷The term "perfect competition" envisions the ultimate in pure competition as defined below. The necessary conditions are specified as existing in a "perfect" degree, rather than in a reasonable or somewhat-less-than-perfect degree. The same degree of perfection in necessary conditions applies to "perfect monopoly."

³⁸R. H. Blodgett, Our Expanding Economy (New York: Rinehart and Company, Inc., 1955), p. 241.

- (2) All parties concerned must have a reasonable amount of knowledge about the conditions prevailing in the market.
- (3) Buyers and sellers must operate independently without agreements and other forms of collusion.
- (4) Freedom of entry or exit to the buying or selling side of the marketing situation must prevail.
- (5) The good being traded must be undifferentiated as to its source from a particular seller.
- (6) There must be no governmental interference with the forces of supply and demand operating freely to determine price.

No empirical marketing situation has all of the requisites of pure competition. In fact the interplay of social forces in the United States has established rather clearly that pure competition as such does not fully attain all the broad objectives of society. These broad objectives are always in a state of change, and in some respects are so nebulous they defy definition. However, they are congealed enough to enable the appropriate regulatory agencies and officials of government to use them in making day to day decisions. The requisites of competition thus are held as ideals from which practical situations are allowed to deviate if society can accrue more benefit from the deviation than from adherence to the ideal.

Deviations from the prescribed pattern for pure competition

will be found in any empirical marketing situation.³⁹ Thus marketing firms operate as buyers and sellers under some form of imperfect competition, while marketing conditions among agricultural producers as sellers are somewhat less imperfect:

. . . conditions of perfect competition in pricing are becoming even rarer. Formerly, those conditions were more nearly approximated in pricing agricultural products. . . . But, one by one, farm commodities have come under the influence of government price supports . . . Many fruits and vegetables are marketed and priced under public or private arrangements Meat animals . . . have seen a marked trend away from central marketing, which presents a reasonable replication of perfect competition, to direct marketing, which bears little resemblance.⁴⁰

Even though they may have many buyers offering to purchase their products, individual producers often develop preferences for a particular buyer over his rivals.⁴¹ Such preferences may be due to location, personality, reputation, or even community pride. When producers' preference exists, buyers have certain control of their supply. Since each buyer is in this sense a monopsonist yet has competitors, the phenomenon is called "monopsonistic competition."

Similarly, on the selling side, when consumers prefer certain sellers, each seller has some degree of monopoly control. But there is still the competition of more-or-less imperfect substitute products

³⁹W. H. Nichols, Imperfect Competition within Agricultural Industries (Ames, Iowa: The Iowa State College Press, 1941), pp. 13-16.

⁴⁰H. F. Breimyer, "Price Determination and Aggregate Price Theory," JFE, August, 1957, pp. 677-78.

⁴¹The following two paragraphs have been taken largely from W. H. Nichols, op. cit., pp. 14-15.

available from other sellers. This phenomenon is called "monopolistic competition." The blending of elements of monopsony, monopoly, and competition is typical of the real world.

The characteristics of the South Florida livestock marketing situation will be examined in order as follows: (1) the number of buyers and sellers, (2) the effect of volume or size, (3) the possession of adequate knowledge about market conditions, and (4) the degree of product differentiation.

Numbers of buyers and sellers.—The South Florida market for cattle is comprised of many sellers and few buyers. From the eleven-county area designated as South Florida (Fig. 1), 1,542 farms and ranches reported 353,166 cattle and calves on hand in 1954.⁴² From this total of 1,542 farms 1,058 of them reported having sold 155,876 cattle and calves.⁴³ In contrast, there are eight slaughtering firms under Federal or State inspection in the greater Miami area, and one in Lake Worth, sixty miles to the north.⁴⁴ Probably at least two-thirds of the cattle and calves sold are slaughtered in Miami.⁴⁵

⁴²U. S. Department of Commerce, Bureau of the Census, United States Census of Agriculture: 1954, Vol. I, part 18 (Washington: Government Printing Office, 1955), Table 7, pp. 103-114. With all due respect for the integrity of Florida citizens, persons well informed on the livestock industry suggest these figures are underestimates.

⁴³Ibid.

⁴⁴Florida State Marketing Bureau, Annual Agricultural Statistical Summary, op. cit., p. 188.

⁴⁵Data available on total slaughter in the area are for 1956 and thus are not strictly comparable with producers' sales of two years

The ratio of buyers to sellers existing in South Florida could result in oligopsonistic competition among buyers.⁴⁶ Yet in itself this ratio is no guarantee that non-competitive trading exists. Furthermore, a dozen buyers dealing with several hundred sellers may discover purely competitive prices, providing they meet the other criteria of pure competition. Certainly, in times when some grades of cattle are relatively scarce, active competition among the few buyers would be expected. Conversely, with supplies abundant there might be some incentive for the few buyers to conspire to keep market prices down. On the other hand, when the volume of cattle offered for sale exceeds the volume that can be sold at current prices, this might indicate unwise marketing practices on the part of producers.

With the exception of those instances when circumstances force a sale, most producers have considerable discretion in deciding when to sell. Marketings of range cattle are seasonally heavy in the fall. A producer who is prepared to carry his cattle a few weeks longer on supplemental feed may profit from higher selling prices. When receipts at a particular auction are relatively light, producers in the area might expect direct sale buyers to be unusually aggressive for a few days following. The informed producer can use this improved bargain-

previous. Approximately 94,000 cattle and calves were slaughtered in state inspected plants in Miami in 1956. These figures do not include one federally inspected plant, the Lake Worth plant, and several small slaughterers not subject to state inspection. Data obtained from the Florida Livestock Board, Tallahassee, Florida.

⁴⁶W. H. Nichols. op. cit.

ing position to advantage. Extreme variation in the quantity of cattle offered for sale in any week, or perhaps any day, probably could be reduced if producers gave more careful attention to prevailing marketing conditions.

Volume or size of firm.—Closely related to the ratio of buyers to sellers in South Florida is the proportion of the total product handled by any individual firm. In South Florida many producers of cattle operate relatively large enterprises.⁴⁷ In a particular marketing period one of these individual sellers could offer for sale a grade of animal in quantity large enough to affect price for the remainder of that period.⁴⁸ The one large sale may be made at a price acceptable to all sellers, but after the first sale buyers no longer are willing to pay this price. Other would-be sellers must then decide whether to hold their cattle until the succeeding period when the price effect of the large sale has deteriorated.

Data on the number of cattle slaughtered by individual packing firms in South Florida are confidential. Observations of the physical plants suggest the potential of some variation in handling capacities, however, the possibility of a dominating firm seems slight. Certain firms specializing in processed meats, buy primarily lower grade cattle,

⁴⁷The development of our economy reflects a general satisfaction with the type of competition that accompanies the efficiencies of large-scale production from a small number of firms.

⁴⁸Smaller producers in the area assert this does take place, and that buyers dwell on this point when chaffering over price.

while others handle all grades. The effect these preferences have on the competitive atmosphere is difficult to estimate. Certainly when a producer wishes to sell a small number of animals in a grade not regularly demanded by all buying firms, he can expect limited bidding. On the other hand, an offer of a large number of this same grade animal would likely provoke bids from all buyers. In no way is this phenomenon a detrimental reflection upon specialization in the industry, rather it is simply a market condition to be recognized.

Possession of knowledge.--Livestock auctions approximate many of the requisites for purely competitive trading more closely than other types of market places. Presumably, each auction individually conducts sales in a competitive manner, however, competition at times may be only "skin deep." In the auction circuit, buyers who travel from sale to sale acquire superior knowledge and are marketing specialists of a sort. Producers are more likely to give marketing only minor attention. The difference in knowledge of market conditions results in an imbalance in bargaining power, and as such is a market impediment. It can be argued that auctions overcome this impediment since many buyers are competing with each other at a sale. But with auctions now handling primarily lower grade animals, the highly competitive buying attributed to auctions may be confined only to these grades.⁴⁹

With many cattle sales in South Florida consummated at the

⁴⁹W. K. McPherson, "How Well Do Auctions Discover the Price of Cattle?" JFE, February, 1956, pp. 30-43.

ranch,⁵⁰ a single individual is hard-pressed to keep informed of prevailing market conditions, particularly price:

The distinguishing feature of determination of price in person vs. person bargaining, as direct sale of livestock, is the absence of other buyers and sellers so numerous and so immediately accessible as to make a given transaction negligible in the market and to convert all pricing into an aggregative process. In its barest essentials person vs. person sale comes close to that of barter There are in fact an infinite number of potential contracts in barter

The area of indeterminateness, i. e., the range over which pricing is subject to the bargaining skill of negotiators, varies widely according to conditions such as the geographic nearness of an organized market, the degree of differentiation of product, and the knowledgeability of each bargainer.⁵¹

To help compensate for the producers' lack of knowledge, the Florida State Marketing Bureau publishes weekly in addition to auction prices by grades, the range of direct-sale prices by U. S. grades of cattle. These direct-sale prices are obtained from packers in the Miami area.⁵² However, to keep strictly current in regard to the country-buying segment of the market, producers must rely on the grapevine method of passing information along. Even though information transmitted through this medium is subject to the personal ad-

⁵⁰H. L. Castle, "The Direct Marketing of Livestock in Florida" (Unpublished M. S. Dissertation, Department of Agricultural Economics, Univ. of Florida, 1956), p. 35. In 1955 twelve South Florida salughter-firms purchased 52 per cent of their cattle and calves directly from producers.

⁵¹H. F. Breimeyer, op. cit., pp. 679-81.

⁵²Similar prices are quoted for Jacksonville-Tampa packers. The reliability of all price quotations is dependent upon the integrity of the buying firms in reporting them.

justment of each link in the chain, the grapevine is a realistic source of market information and is a genuine part of the over-all marketing picture.

Cattlemen do have some opportunity to avail themselves of information on local market prices. Much of the price data for individual auctions, that is summarized weekly by the State Marketing Bureau, appears in local newspapers a day or two following the auction. Many auctions mail out flyers publicizing their prices. While auctions' prices seem to be adequately covered, the direct sale price quotations may be as much as a week old. This emphasizes the need for more adequate coverage of market information on direct sales. Producers can help compensate for the lack of current information by inviting several bidders on direct sales.

Obtaining alternative bids on a lot of cattle is not as simple as it may seem. Some buyers will quote only carcass grade and weight bids over the telephone, while others will not quote a price without inspecting the cattle. After inspecting the cattle many buyers will not make a firm bid but offer a price for only immediate sale. If a cattleman calls in one bidder after another he may be unable to obtain two or more firm bids for comparison. Smaller producers are more likely than larger producers to encounter this problem.

It appears that the distribution of knowledge about conditions prevailing in the marketing area in South Florida is not equal among all parties concerned, and constitutes a deviation from that expected under a purely competitive situation.

Differentiation of product.—As for the goods traded in the market being undifferentiated this facet becomes somewhat elusive when referring to cattle. Cattle may be differentiated by breed and sex. Generally speaking, a particular grade of cattle such as U. S. Good is relatively homogeneous, enough so that price quotations by grades are not misconstrued, if there has been no inaccuracy in estimating the live-animal grade. At a particular market place however, animals are identifiable by cattlemen's brandmarks. In the minds of buyers and sellers, some producers are associated with certain breeds or cross-breeds. Thus some degree of identification is possible, for instance in an auction ring, and buyers are able to discriminate if they so choose. In direct sales the product is differentiated "except when terms of sale provide for carcass grading on the rail."⁵³ Considering the cattle market as a whole this deviation from an ideal is not too serious and furthermore would be difficult to overcome. The important point is for market-wide prices by grades to be associated with relatively homogeneous types of animals.

Evaluation of competition in the area.—Conditions observed in the marketing situation for cattle in Miami are fairly typical of the markets for many agricultural products. In the production area farmers and ranchers are considerably scattered geographically. Thus there is some probability of a limited number of buyers available to any one seller desiring to make direct sale of cattle at the ranch.

⁵³H. F. Breimeyer, op. cit., p. 678.

At the same time the spatial dispersion of producers might induce buyers to share the buying territory in some fashion.

The size of operation of some cattle producers at least creates a potential for some degree of control over market supply and hence price. However, apparently this element of bargaining power is not often used. On the buying side no one firm appears to have a great enough capacity to exert dominance in the industry.

The availability of market information is not perfect, particularly regarding direct sales. However, producers can try to overcome this disadvantage somewhat by being more aggressive in using what information is available in calling for bids from several buyers.

Only one auction serves the general area, and this is an outlet for primarily lower grade cattle. With the extremely small volume of high grade cattle sold at auction, it is unlikely that there are enough buyers of high grade cattle attracted to the sale to attain a fully competitive price. On the other hand, prices of lower grade cattle at the auction probably are discovered under active competitive bidding.

Producers of higher grade cattle for the Miami market sell largely by direct sale. In this type of negotiation unequal bargaining power between buyers and seller make the marketing situation quite imperfect. Prices discovered in this sort of competitive environment might well differ from those expected under purer competition. But before examining the difference between the market price quotations and

the conceptual prices expected, it is necessary to know something about the validity of such comparisons.

CHAPTER IV

THE VALIDITY OF PRICE COMPARISONS

If buyers and sellers are to use price quotations as one of the principal bases for making marketing decisions of when and where to trade, they must be sure of the kinds of products to which the prices refer. To this end many products are divided into grades, and prices quoted accordingly.⁵⁴ When the attributes specified in the grades can be measured or evaluated with reasonable objectivity, for example, by size, weight, or laboratory test, differences in prices of grades among regions can be observed with a high degree of validity. Conversely, when the grade attributes are measured in large part by subjective judgment, there is a realistic but indeterminate probability that some of the grade designations are incorrect.

It is general knowledge in the livestock and meat industries that all graders of meat and animals perform with some inaccuracy in their judgment of grades. The question of inaccuracy in judgment takes on particular significance where public agencies employ livestock and meat graders, because the bulk of market news circulated is based on the federal grades designated by these men. Incorrect grading leads

⁵⁴W. K. McPherson, L. V. Dixon, and H. L. Chapman, Jr., An Economic and Statistical Analysis of Grading Cattle, Florida Agricultural Experiment Station (Gainesville: University of Florida, 1959), pp. 1-11, (bulletin manuscript).

to inaccurate price quotations in market reports and is a source of market imperfection. To the extent that market reports compiled by public agencies differ from market reports compiled by private firms the bargaining power of individuals using one or the other reports will be out of balance. In any case the validity of price comparisons is dependent on the assumption that market-wide prices by grades are associated with relatively homogeneous types of animals.

The bargaining powers of buyers and sellers of cattle are to a considerable degree dependent also upon their relative abilities to estimate the carcass grades of live animals.⁵⁵ When this ability of human beings plays such an important role in the livestock marketing system, accuracy in estimating grade cannot be overemphasized. Thus initially attention was focused on the ability of men to grade live animals.

Variation of Errors-of-Estimate in Grading Live Animals⁵⁶

Review of literature.—One of the earliest statistical studies of grading performance analyzed the errors-of-estimate made by one packer buyer who estimated the grades and yields of 400 slaughter animals.⁵⁷

⁵⁵Although the live animal grade is referred to as a "grade," it is really an estimate of the meat grade of the carcass produced after slaughter.

⁵⁶An error-of-estimate is the difference between the official U. S. grade of a carcass, as designated by a federal meat grader, and an estimate of this grade. Live-graders estimate the carcass grade by observing the characteristics of live animals.

⁵⁷A. A. Dowell et. al., Marketing Slaughter Cattle by Carcass

The data were subsorted into groups by class of cattle, and by final carcass grade, and the variance of the errors-of-estimate calculated for each grouping. Using Snedecor's F test⁵⁸ the many combinations of pairs of variances were tested for significant differences. The physical errors in grade and yield were converted to price errors using 1937-41 average prices at Chicago. Variances in units of value were calculated and tested for significant differences. When the individual animal records were combined to form lots, overestimates tended to cancel underestimates and errors-of-estimate were reduced.

Another study focused on a comparison of pricing accuracies among three methods of marketing butcher hogs: the liveweight method in use at that time (1953), a proposed live-weight and grade method, and a proposed carcass weight and grade method.⁵⁹ Pricing error was defined as the difference between cut-out value and price paid for the hog.

The performance of live-graders has been compared also in terms of percentage of correct estimates and percentage of estimates

Weight and Grade, Minnesota Agricultural Experiment Station, Technical Bul. No. 181 (Minneapolis: University of Minnesota, 1949).

⁵⁸G. W. Snedecor, Statistical Methods (4 ed.; Ames; Iowa State College Press, 1946), p. 249 (5 ed.; Ames: Iowa State College Press, 1956), p. 96.

⁵⁹Gerald Engelman et al., Relative Accuracy of Pricing Butcher Hogs on Foot and by Carcass Weight and Grade, Minnesota Agr. Exp. Sta. Technical Bulletin No. 208 (Minneapolis: University of Minnesota, 1953).

within plus or minus one grading unit of correct.^{60, 61, 62, 63}

The analysis of variance in a linear regression of carcass grades on the estimated grades in another technique stemming from the Minnesota data.⁶⁴ In this approach the differences between mean errors-of-estimate associated with the various classes of cattle, and the differences between sample regression coefficients and a parameter of one, were tested for indications of randomness.

Comparisons of errors-of-estimate among live-graders.— None of the studies cited above dealt with the performance of more than one live-grader. To explore the nature of variation in errors-of-estimate among several graders of live cattle, preliminary grading trials were conducted at the Everglades Experiment Station in the spring of 1957 and 1958. Additional data were obtained from a grading trial conducted

⁶⁰Early studies set the precedent for using one-third of a federal grade as the preferred grading unit, apparently on the assumption that human judgment could make no finer breakdown.

⁶¹C. D. Phillips and James L. Pearson, Accuracy of the Present Methods of Pricing Veal Calves, Slaughter Cows, and Lambs, Kentucky Agricultural Experiment Station Bulletins 610, 611, 612 (Lexington: University of Kentucky, 1954).

⁶²E. S. Clifton, Pricing Accuracy of Slaughter Cattle, Veal Calves and Lambs, Indiana Agricultural Experiment Station Bulletin No. 611, North Central Regional Publication No. 53 (Lafayette: Purdue University, 1954).

⁶³J. J. Naive et al., Accuracy of Estimating Live Grades and Dressing Percentages of Slaughter Hogs, Indiana Agricultural Experiment Station Bulletin 650 (Lafayette: Purdue University, 1957).

⁶⁴E. H. Jebe and E. S. Clifton, "Estimating Yields and Grades of Slaughter Steers and Heifers," JFE, May, 1956, pp. 584-96.

by the Louisiana Experiment Station in 1955.⁶⁵

The live-graders made independent estimates of the slaughter grade on each animal individually. Most of the live-graders had previous experience in grading live cattle and checking their estimates against the grades of the carcass. Forty-eight hours after slaughter the official government meat grades of the carcasses were designated by a federal meat grader. The grade designation after slaughter is in the judgment of an official meat grader representing the U. S. Department of Agriculture.

For purposes of calculating error-of-estimate in live-grading, the meat grader's judgment is assumed to be correct or final. The meat grader's subjective judgment must be taken as correct or final, otherwise the function of the grading system as an arbitrator in trading negotiations would fail.⁶⁶ The preceding assumption is not intended to imply an infallibility of the meat grading system. Since meat graders are human, certainly they must make some errors in their judgment of grade, but as long as the final grade of any carcass is designated subjectively, there can be no real measurement of this error.⁶⁷

⁶⁵This trial was conducted in connection with regional research project SM-7, "Marketing Livestock in the South."

⁶⁶Its failure would reflect the unwillingness of individuals to accept and adhere to the referee powers of the federal government in matters of internal trade. It is characteristic of the people of the United States that they accept without violence the edicts of Congress. Generally, this acceptance is with reluctance on the part of some.

⁶⁷The federal meat grading service defends the accuracy of

To evaluate the differences among live-grading performances of several individuals some method of summarizing the observations is necessary. The aggregation of errors-of-estimate made by an individual grading a lot of live animals can be considered as a frequency distribution (Fig. 4). In this way a mean and a standard deviation of the distribution will describe a grader's performance.⁶⁸ The mean and standard deviation are particularly relevant since they concern the statistical concepts of accuracy and precision as used in sampling terminology. Accuracy is defined:⁶⁹ If a sample estimator gives estimates which average very close to the true value being estimated, the estimator is said to be relatively accurate. Precision means the ability of an estimator to give repeated estimates which are very close together.⁷⁰ With reference to a grader's distribution of errors-of-estimate on a lot of animals, the mean indicates accuracy while the

their judgment of grade on the basis of the packers' privilege to dispute the initial designation of grade. The packers appeal on carcass grades may be answered by examining the loin for characteristics of grade. The next higher appeal requests a referee grader to examine the meat. If necessary the appeal can be taken to higher levels of the grading service. However, most disputes are settled by examining the loin. Until grade attributes of meat can be measured objectively, the correct grade and thus the accuracy of meat grading is indeterminate.

⁶⁸Another measure of performance describes the variation of the estimates around their corresponding meat grades, much like the measurement of the conventional standard error of estimate. Cf. W. K. McPherson, et. al., op. cit., pp. 27-54.

⁶⁹Bernard Ostle, Statistics in Research (Ames: Iowa State Press, 1954), p. 84.

⁷⁰Ibid.

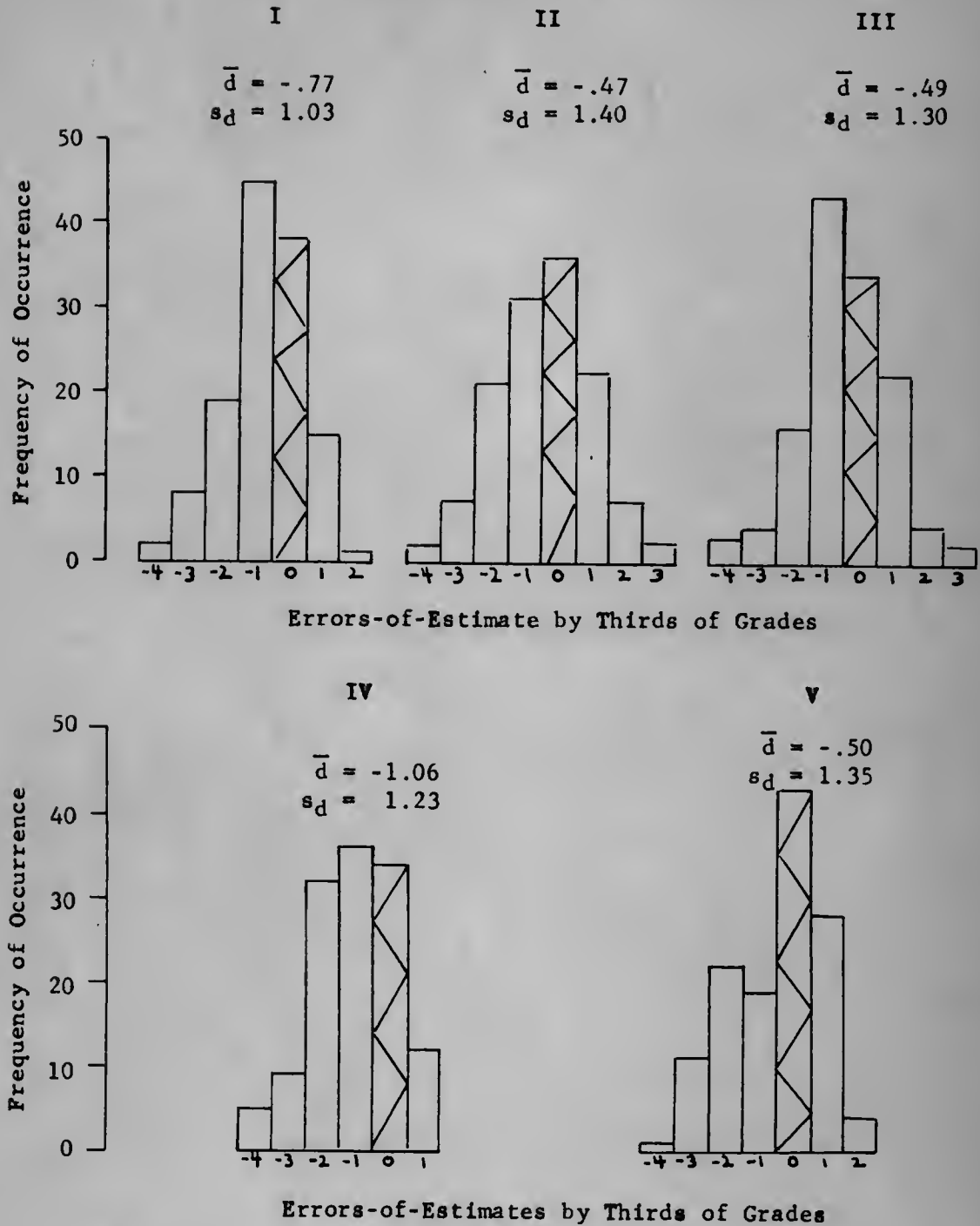


Fig. 4.--Frequency Distributions of Errors-of-Estimate in Live-grading, for Five Selected Live-graders, on 128 animals, by Thirds of U. S. Grades.

standard deviation (or variance) indicates precision. Perfection in grading is indicated by a value of zero for both the mean error-of-estimate and the standard deviation of error-of-estimate.

Only a relatively small number of observations were available for each live-grader.⁷¹ In three separate grading trials, the mean and standard deviation of errors-of-estimate exhibited some variation in magnitude (Table 7). Of the combined group of twenty-six men, the most accurate live-grader came within .13 thirds of a U. S. grade of being correct on the average. The least accurate live-grader was off an average 1.83 thirds of a U. S. grade. The average estimates of five graders were underestimates, in contrast to the overestimates of the sixteen. Thus, the tendency of the mean error-of-estimate to over-estimate or underestimate may be interpreted as a bias in a live-grader's judgment of the grades of cattle.

The ability of a man to estimate the grades of cattle in such a way that his errors-of-estimate are more nearly alike or precise, in the sense defined above, is indicated by the standard deviation or variance of his distribution of errors-of-estimate. In the group of twenty-six men the live-grader who was most precise or consistent in his errors-of-estimate had a standard deviation of 1.15 thirds of a U. S. grade (Table 7). The inconsistent live-grader had a standard

⁷¹Five men graded 128 steers; eleven men graded 119 steers; ten men graded a lot of 236 animals composed of: 86 heifers, 82 calves, 45 cows, and 23 steers. The three groups of live-graders included several market reporters as well as professional animal husbandmen.

TABLE 7

ARRAYS OF MEAN ERRORS-OF-ESTIMATE AND STANDARD DEVIATIONS
OF ERRORS-OF-ESTIMATE, FOR TWENTY-SIX SELECTED
LIVE-GRADERS, ON SELECTED LOTS OF ANIMALS

Mean Error-of-Estimate	Standard Deviation of Error-of-Estimate
.13	1.15
.16	1.23
.20	1.30
.26	1.35
.30	1.394
.34	1.3970
.36	1.3972
.43	1.40
.44	1.43
- .47	1.45
.48	1.46
- .49	1.49
- .50	1.52
- .77	1.57
-1.06	1.58
1.29	1.61
1.43	1.62
1.445	1.66
1.454	1.671
1.54	1.672
1.55	1.68
1.57	1.71
1.72	1.76
1.74	1.777
1.81	1.78
1.83	1.81

deviation of error-of-estimate of 1.81 thirds of a U. S. grade.⁷²

When data from a group of small samples are observed, it is not unusual to find comparatively large differences among individual samples. Therefore, the three grading trials should not be taken as representative of live-grading in general, but simply as rough indications of what degree of proficiency in live-grading may be possible. With small samples, and even when grading in thirds of U. S. grades, thirteen of twenty-six men were proficient enough that their errors-of-estimate averaged less than one-sixth of a full U. S. grade.⁷³ If the men had been instructed to estimate only the full U. S. grade of each animal, their errors-of-estimate might have been reduced considerably.⁷⁴ A reduction in errors-of-estimate would also be expected if large samples of each man's grading were observed.

⁷²Since there are a finite number of carcass grades, distributions of errors-of-estimate cannot approach normality to any high degree. In all grades but Canner and Prime, errors-of-estimate may be at least as large as three thirds above or below the carcass grade. The sample data suggest that a range in thirds of grades from minus three to plus three will include the vast majority of errors-of-estimate. Therefore, assuming that errors-of-estimate tend to be distributed symmetrically around a mean, the orthodox interpretation of the standard deviation is appropriate.

⁷³This does not mean it is possible to estimate to the nearest sixth of a grade. Small averages result from overestimates offsetting underestimates.

⁷⁴When counting as incorrect only those estimates placing animals in different whole grades than their carcasses, the percentages of correct estimates for the five men in one of the grading trials increased as follows: 30 per cent to 69 per cent, 28 per cent to 66 per cent, 27 per cent to 63 per cent, 27 per cent to 60 per cent, and 34 per cent to 59 per cent.

The effect of grading errors on price comparisons.—Market reporters in a days work customarily grade hundreds of cattle and calves in each U. S. grade. Therefore, their errors-of-estimate on such large numbers of animals would be expected to average somewhat differently than indicated in a small sample. Even if market reporters' proficiencies were no better than those in the three trials cited above, the effect on reliability of price quotations would not be serious enough to discredit market reports. Nevertheless, any improvement in the accuracy of grading leads to a more accurate reflection of market price and is a gain in the efficiency of the livestock marketing system.

Simple observation of the arrays of the two measures of grading ability (Table 7) suggests that bias tends to vary more among live-graders than does consistency. These tendencies can be tested statistically if the data approximate the assumptions of the appropriate tests. Unfortunately the data from the three grading trials were not obtained in a manner to permit statistical testing. Essentially, the statistical approach examines the differences among mean errors-of-estimate for indications of significant or real differences among the abilities of men to grade cattle. One possible method of testing, employing analysis of variance, is illustrated in Appendix I.

Variations observed in the grading errors of the men in three preliminary grading trials are mute testimony to the human element in marketing cattle. It is an impediment in the marketing system that probably can never be eliminated, but its effects may be reduced if

(1) the grade standards are revised to include attributes that can be measured objectively,⁷⁵ and (2) graders employed by public agencies are carefully selected and trained to confine their errors-of-estimate within acceptable limits. With the aid of the measures of ability discussed in this chapter, the acceptable degrees of grading proficiency can be specified.⁷⁶ Private firms can also establish standards of performance for the graders they hire. When reliable estimates have been calculated for the sizes of errors made by both live animal graders and meat graders in the various segments of the industry, this will permit traders to inject into their negotiations more realistic adjustments for the errors in grading.

As far as current price reporting is concerned, an error of a third of a grade in live-grading may not reflect any economic significance unless it places an animal in a different whole grade than that designated by the meat grader. For instance, a price report based on an estimate of high U. S. Good on a lot of animals whose carcasses actually graded low U. S. Choice would be an inaccurate reflection of the real situation and a source of misinformation for traders. If the same lot actually graded middle or low U. S. Good, the prices as now reported would not reflect the error.

⁷⁵To date, no such attributes have been identified, however, a sonic device measuring thickness and density of fat, muscle, and bone is being tested. Perhaps other electronic devices, and chemical tests will some day be developed.

⁷⁶McPherson et al., op. cit., pp. 55-57.

Much larger samples and many more samples of the performance of each live-grader would have been more desirable. Yet the evidence available supports the assumption that in a population or universe sense a grader's errors-of-estimate are symmetrically distributed. Furthermore, the magnitudes of the sample mean errors-of-estimate suggest that for many graders the mean of their populations of errors-of-estimate may be close to zero. The samples also show a tendency for a grader's overestimates to offset his underestimates.

Thorough testing of the hypothesis and assumptions suggested in the available data will not be possible until adequate samples of grading performance are drawn from the population of live-graders upon whose estimates market price reports are based. However, on the basis of available evidence, the accuracy of market price reports can be assumed to be within acceptable limits.

CHAPTER V

PRICING EFFICIENCY IN THE MIAMI MARKETING AREA

The efficiency of pricing cattle in the Miami marketing area will be evaluated by comparing the price quotations for the area with the estimated competitive wholesale buying prices derived as outlined in Chapter II. However, the existence of any difference whatsoever between the quoted price and the estimated competitive price will not in itself be considered bona fide evidence of inefficiency. Even with effective competition among buyers the price paid for a live animal may be less than the liveweight equivalent of its carcass price if byproduct value does not cover the packer's costs.⁷⁷ This relationship is discussed below in connection with the problem of byproduct recovery in the Miami area.

National averages of the liveweight equivalent of U. S. Choice carcass prices and the prices of U. S. Choice steers can be compared quarterly. Since Florida in general and Miami in particular must rely on the surplus areas for higher grade beef, the relationship between carcass prices and live prices in Miami would be expected to follow more or less the national pattern. Deviations from the national

⁷⁷A live price less than the carcass price could also arise from the superior bargaining position of buyers acting in imperfect competition and securing wider margins.

pattern of differences between carcass prices and live prices, after making an allowance for the byproduct situation in Miami, will be the basis for judging the efficiency of cattle prices in the Miami marketing area.

Byproduct Recovery

The total value of an animal includes salable meat plus animal offal. When the packer sells the meat and byproducts from an animal, he hopes to receive prices sufficient to pay for the live animal and all costs and returns involved.⁷⁸ An estimate of the marketing margin retained by the packer can be obtained by subtracting the price paid for a live animal from the wholesale value of the meat and byproducts.⁷⁹

$$(5) \text{ Meat} + \text{Byproducts} - \text{Live Animal} = \text{Cost and Margins}^{80}$$

If equation (5) is rearranged as

$$(6) \text{ Meat} - \text{Live Animal} = \text{Costs and Margins} - \text{Byproduct}$$

it can be seen that the difference between the live animal price and the liveweight equivalent of the meat price would ideally reflect the difference between byproduct value and packers costs and margins.

⁷⁸Costs and returns include payments to land, labor, capital, and entrepreneurship.

⁷⁹U.S.D.A., Beef Marketing Margins and Costs, Misc. Pub. No. 710 (Washington: Government Printing Office, 1956), p. 10.

⁸⁰The figures to be substituted into the left side of the equation must all be expressed in the same units of product, that is, per pound, per hundredweight, and so forth. They can be in terms of carcass weight or liveweight.

The byproduct situation in Miami differs from many other areas in that no complete rendering plant is located near enough to provide an outlet for all this material. With the exception of hides and what offal is sold to a soap maker, the rest is hauled away to dump.⁸¹ Some packers have argued that the value of byproducts recovered at Miami is only sufficient to pay for hauling the waste away, thus the packer must deduct the full amount of costs in arriving at his price of live animals. Others are of the opinion that the byproduct value per hundredweight of live animals at Miami is roughly a dollar below that realized by the rest of the packing industry in Florida.⁸² Cattlemen are inclined to feel that they are being deprived of additional income because the Miami packers have not seen fit to develop rendering facilities.

Evidently the estimated profitability from operating a rendering plant in or near the greater Miami area has not yet been attractive enough to any business enterprisers. Furthermore, cattle producers in South Florida are at somewhat of a locational disadvantage in trucking to other outlets. The plants either operating or served by more complete rendering facilities, and which are the al-

⁸¹With the volume of animals slaughtered in Miami it is strange indeed that even a small rendering plant has never been built. At least one packer in the state, smaller than most of those in Miami, operates his own rendering cookers on a very profitable basis.

⁸²This figure was suggested in interviews with several packers located in central Florida who represent the nearest alternative outlets for South Florida cattle.

ternative outlets to South Florida cattlemen, are not located near enough to overcome the transportation advantage of Miami buyers. Therefore, the forces of competition have not encouraged Miami packers to build a more complete rendering plant. Until a thorough study has been made of the economic feasibility of rendering in the Miami area, the existing byproduct situation cannot be evaluated objectively.

Estimated Competitive Prices Vs. Prices
Reported F.O.B. Plant

If reliable estimates were available in the Miami area for all four factors in equation (6), an evaluation of the equitability of live animal prices would be relatively simple. Live animal prices are reported at many points in the nation, while carcass prices are available only from reports for a few marketing areas outside the Southeast. Byproduct prices are reported only at Chicago, and the information on packers costs is published by the meat-packing industry as national averages.⁸³

Nevertheless, although lack of complete knowledge makes it difficult, it does not preclude making some judgment as to what differences between the live animal price and its estimated competitive level would be expected at Miami. In the major wholesale meat

⁸³In 1957 each dollar of meat packers' sales was distributed as follows: 74 cents paid for livestock and raw material; 13 cents for wages and salaries; one cent for taxes; 11.3 cents for other expenses; and .7 cent total net earnings. American Meat Institute, Financial Facts About the Meat Packing Industry (Chicago: American Meat Institute, 1958), inside cover page.

markets located near surplus producing areas, buyers for large chain stores compete with buyers serving Florida packers. Florida packers selling carcasses and meat to chains and other wholesale buyers could not expect to receive more than it would cost these customers to buy in the surplus area and ship to their point of delivery. The competitive wholesale buying price equation presented in Chapter II expresses this relationship as the surplus area price plus transfer costs.

When dealing with smaller buyers lacking the purchasing advantage of chains the packer might sell at a higher price. Also, Miami area packers providing wholesale services for a clientele of hotel and restaurant customers might receive somewhat higher prices for the higher-priced grades and cuts of beef. Thus in this respect the midwest price plus freight underestimates the wholesale buying price locally.

On the other hand to meet competition, national packers operating in the area conceivably might ship carcasses in from parent plants in the midwest at prices below quotations in public market news reports. If, in turn, they sell at a lower price, the independent packer must meet this competition as best he can. In this respect the midwest price quotation plus freight overestimates the wholesale buying price locally.

Prices of U. S. Choice Grade.—In the analysis that follows, the lows of the price ranges are compared. It is assumed that the lows more nearly represent prices of comparable animals in the grade.

Prices paid for live animals F.O.B. plant Miami have been reported by the State Marketing Bureau only since August, 1957. From August, 1957, until March, 1959, the price of U. S. Choice at Miami fluctuated generally below its estimated competitive level. (Fig. 5). The gap was widest late in 1957 and early in 1958 ranging from approximately \$1.75 to \$3.50 below. During this period the wholesale value of byproducts at Chicago, as reported quarterly, was relatively stable averaging \$2.27 per hundredweight of live steer U. S. Choice grade (Table 8). Thus, even if Miami packers were obtaining full byproduct value from animals, the degree of fluctuation observed in cattle prices at Miami would not have been attributable to a similar variation in byproduct value.

In the three-year period from 1956-1958, with the exception of two quarters, the national average live price of U. S. Choice steers was consistently below the liveweight equivalent of the carcass (Table 8). This suggests the byproduct value in this period was not sufficient to cover costs (see equation 6, p. 58), hence the full value of the meat was not paid for the live animal.⁸⁴ In the second quarter of 1958, byproduct value and carcass value reached their highest levels for the period (twelve quarters) and the live price exceeded the equivalent of the meat price by 48 cents per hundred-

⁸⁴However, there is no fundamental reason to believe these costs always fluctuate with the offal value, or vice versa. In fact from early 1951 to the fall of 1955 the byproduct values fell \$2.30 while labor costs rose. U. S. Dept. of Agriculture, Beef Marketing Margins and Costs, op. cit., p. 9.

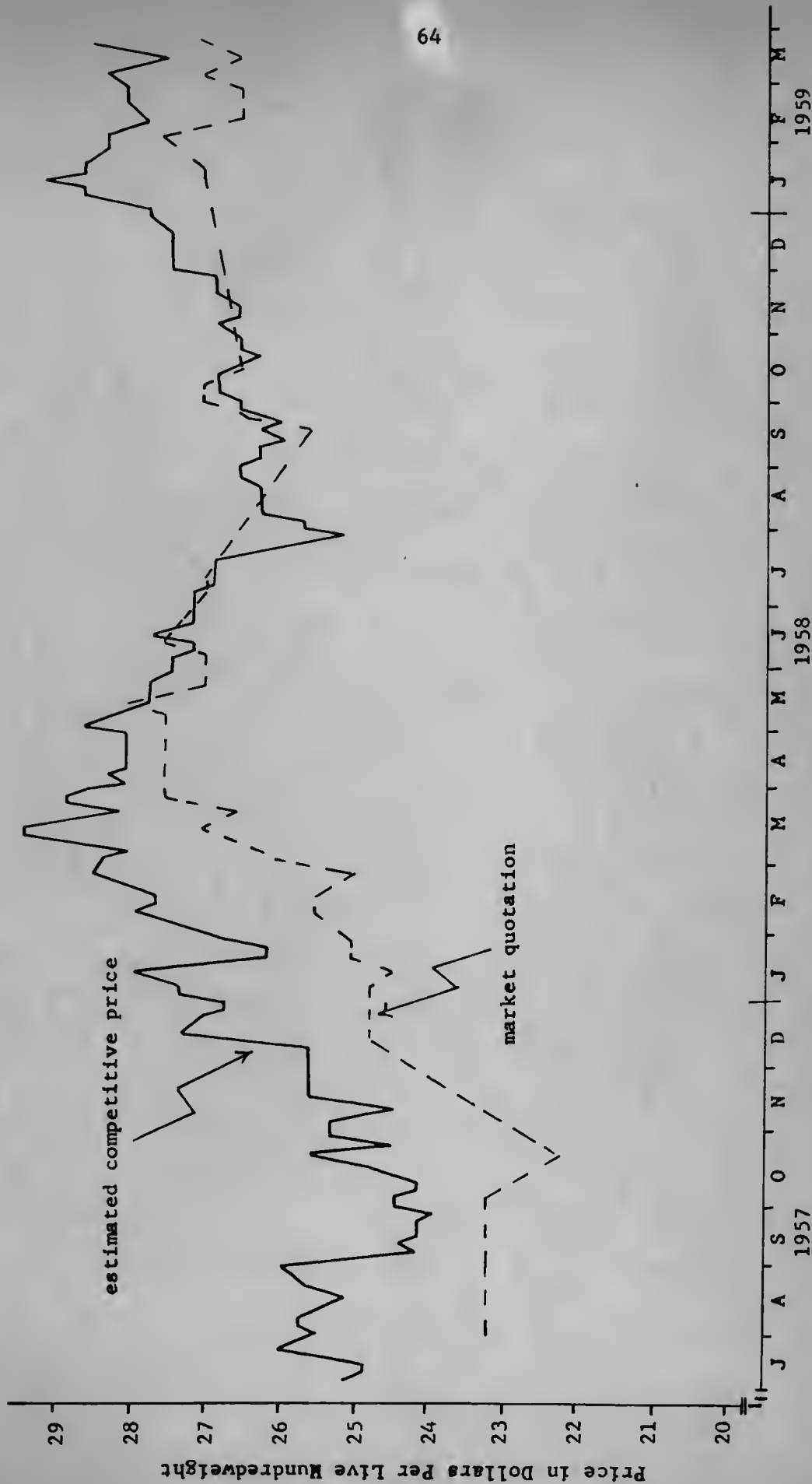


Fig. 5.--U. S. Choice Steers at Miami: Estimated Competitive Price* F.O.B. Plant and Market News Price Quotation F.O.B. Plant, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to March, 1959.

*Estimated competitive price equals (carcass price at Chicago plus freight to Miami) $\left(\frac{58}{100}\right)$.

TABLE 8

LIVE TO WHOLESALE PRICE SPREADS, U. S. CHOICE GRADE STEERS
BY QUARTERS, 1956-58^a

Quarter	Price of Steers ^b	Wholesale Value			Spread
		Carcass ^c	Byproducts ^d	Total	
(dollars per 100 pounds liveweight)					
1956					
Jan.-Mar.	19.47	21.02	1.83	22.85	3.38
Apr.-June	20.30	20.79	2.00	22.79	2.49
July-Sept.	23.76	25.21	2.14	27.35	3.59
Oct.-Dec.	22.67	23.70	2.06	25.80	3.13
1957					
Jan.-Mar.	20.48	21.48	1.92	23.40	2.56
Apr.-June	22.85	23.39	2.15	25.54	2.69
July-Sept.	24.30	25.15	2.30	27.45	3.15
Oct.-Dec.	24.27	24.68	2.06	26.74	2.47
1958					
Jan.-Mar.	27.09	27.36	2.17	29.53	2.44
Apr.-June	28.46	27.98	2.40	30.38	1.92
July-Sept.	26.39	26.64	2.35	28.99	2.60
Oct.-Dec. ^e	26.81	26.67	2.34	29.01	2.20

^aSource: U. S. Department of Agriculture, The Marketing and Transportation Situation, MTS-126, MTS-131 (Washington: Government Printing Office, July, 1957, and February, 1959).

^bWeighted average of price at 21 leading public stockyards.

^cFifty-nine per cent of average wholesale price of 100 pounds of carcass beef.

^dWeighted average of prices reported in the National Provisioner magazine.

^ePreliminary estimates.

weight. Again in the fourth quarter of 1958 the live price exceeded the equivalent meat price. For these two quarters it appears that byproduct value was sufficient to cover costs and packers were retaining a narrower margin (Table 8).

Since 1958 was year of relatively short supply of slaughter cattle it might be argued this factor was enough to force live prices above meat prices. In addition the demand for feeder cattle was exceptionally strong in the spring of 1958. No doubt both these developments combined with the higher byproduct value in the two quarters of 1958 to reinforce the tendency of live price to rise above meat price. However, no packer could long afford to pay more than the meat price for live animals if byproduct value was not covering costs and returns.

To arrive at some judgment of the differences between the price F.O.B. plant and the liveweight equivalent of the estimated competitive wholesale buying price of carcass meat at Miami, it is necessary to decide arbitrarily whether or not this price differential at Miami should be greater than the national average. This decision is arbitrary because of the peculiar byproduct situation in Miami. In the following analysis it has been assumed that if offal at Miami is worth one dollar less per live hundredweight than in other areas, the differential between estimated competitive price and plant price may be as much as one dollar greater than national figures indicate (see footnote 82, p. 59).

With this assumed standard as a guide, the differential for U. S. Choice steers at Miami exhibits some shortcomings on several occasions (Table 9). Unfortunately only six weekly price comparisons for 1957 are available, but for the first ten months in 1958, direct sale quotations F.O.B. plant for U. S. Choice steers at Miami were more frequent. No quotations on U. S. Choice steers at Miami were reported between November, 1958, and February, 1959.⁸⁵ Because of the nature of the data, average weekly differentials at Miami are compared against average quarterly differentials nationally. In effect the Miami differentials are viewed as weekly fluctuations about the national quarterly averages; the national weekly fluctuations are masked.

In three instances during the latter half of 1957 the differential for U. S. Choice steers at Miami (Table 9, column 2) was comparatively wide. It narrowed in December, 1957, but widened again in January, 1958, remaining so until April, 1958. With this evidence it appears that from August, 1957, to April, 1958, prices paid live-weight at Miami for U. S. Choice steers were below those expected under reasonably competitive marketing conditions. From April, 1958, through October, 1958, the differential generally remained within the limits postulated as acceptable to reason.

⁸⁵At this writing the national averages for the first quarter of 1958 have not been released, therefore no comparisons are presented for 1959 prices.

TABLE 9

DIFFERENTIALS BETWEEN SELECTED PRICES OF LIVE ANIMALS AND
LIVEWEIGHT EQUIVALENTS OF ESTIMATED COMPETITIVE PRICES FOR
CARCASSES, U. S. CHOICE STEERS,
AUGUST, 1957, TO OCTOBER, 1958

Week In- cluding	Miami Live Price ^a Minus Estimated Competitive Carcass Price Equivalent	National Live Price ^b Minus National Car- cass Price Equivalent (Quarterly Averages)	National Quarter- ly Average Dif- ferential Ad- justed for Miami Byproduct Credit ^c
(1)	(2)	(3)	(4)
(dollars per 100 pounds liveweight)			
8/8/57	-2.21	-0.85	-1.85
10/10	-1.18	-0.41	-1.41
10/31	-3.35	-0.41	-1.41
11/7	-2.55	-0.41	-1.41
12/12	-1.10	-0.41	-1.41
12/19	-0.85	-0.41	-1.41
1/2/58	-2.29	-0.27	-1.27
1/16	-2.58	-0.27	-1.27
1/23	-3.41	-0.27	-1.27
1/30	-1.17	-0.27	-1.27
2/6	-1.75	-0.27	-1.27
2/20	-2.42	-0.27	-1.27
2/27	-2.13	-0.27	-1.27
3/6	-3.52	-0.27	-1.27
3/13	-2.02	-0.27	-1.27
3/20	-2.97	-0.27	-1.27
3/27	-1.89	-0.27	-1.27
4/3	-2.39	+0.48	-0.52
4/10	-1.10	+0.48	-0.52
4/24	-0.52	+0.48	-0.52
5/8	-0.52	+0.48	-0.52
5/15	-0.81	+0.48	-0.52
5/22	+0.28	+0.48	-0.52
5/29	-0.72	+0.48	-0.52
6/5	-0.44	+0.48	-0.52
6/12	-0.44	+0.48	-0.52
6/19	+0.36	+0.48	-0.52
7/10	-0.14	-0.25	-1.25
7/17	+0.14	-0.25	-1.25
9/25	-0.78	-0.25	-1.25
10/2	+0.22	+0.14	-0.86
10/9	+0.44	+0.14	-0.86
10/16	+0.14	+0.14	-0.86
10/23	-0.06	+0.14	-0.86

TABLE 9.—Continued

^aSource: U. S. Department of Agriculture, Florida Department of Agriculture, Florida Weekly Livestock Summary, Vol. XXX (1957) and Vol. XLI (1958) (Thomasville, Georgia: Mimeographed, 1957, 1958).

^bSource: U. S. Department of Agriculture, The Marketing and Transportation Situation, MTS-132 (Washington: Government Printing Office, January 1959).

^cColumn 3 plus a minus \$1.00.

Prices paid at the ranch.--Interviews with cattlemen in South Florida in 1958 indicated that while direct selling was a popular method of trading, very few sales were based on carcass grade and weight. The cattlemen felt that liveweight prices offered by buyers were just as attractive as carcass price offers. This is understandable in a year such as 1958 since cattle were withheld to build up herds, and buyers became particularly aggressive. Ordinarily the carcass price offer would be expected to be somewhat more attractive than the live price offer for the same grade, because the buyer would not have to allow for his errors in estimating live animal grades.

One other factor seemed to influence the cattlemen's preference for liveweight sales. It involved some sort of feeling of self-assurance that a transaction based on liveweight prices was more satisfactory because the cattleman personally had estimated the grade of his animals. There was an outspoken expression of suspicion of the integrity of packers to faithfully report the carcass grades of animals and pay accordingly. A few respondents suggested the possibility of collusion between packers and federal meat graders. While it is possible for producers who sell on carcass grade and weight to watch the actual slaughtering and grading of their animals, this is not a very practical solution to the problem of distrust, particularly when producers live long distances from the packing

plant.⁸⁶ In areas where carcass grade and weight selling is prevalent, such as the Southwest and California, apparently competition among buyers is keen enough to build up producers' confidence in this method of sale. No doubt there also are instances where a personal respect and trust between buyer and seller exists.

The grades of cattle sold by liveweight in direct sales cannot be obtained with a very high degree of confidence from personal interview with producers. While cattlemen who keep no records may recall quite accurately the prices received in previous transactions, there is no objective way to associate these liveweight prices with the grades of the particular animals. Furthermore, most liveweight direct sales are consummated by a single price for loads of mixed grades of cattle. Price by grade cannot be identified confidently unless the sale was based on carcass weight and grade.

Interviews with cattlemen in South Florida produced only an infinitely small amount of data on prices paid in grade and weight sales. These data indicate that in nine sales at the ranch between August, 1957, and January, 1958, the prices paid were somewhat higher than the lows of the reported price ranges (Table 10). Nine observations are not enough to warrant drawing any conclusions about how actual prices paid at the ranch compare with the prices reported

⁸⁶The problem may eventually be resolved by producers organizing cooperative slaughtering plants and selling graded carcasses to meat processors and wholesalers.

TABLE 10

COMPARISON OF ESTIMATED COMPETITIVE PRICES F.O.B. PLANT MIAMI
AND SELECTED PRICES PAID AT RANCH ADJUSTED TO APPROXIMATE
F.O.B. PLANT, FOR U. S. CHOICE STEERS^a

Week Includ- ing	Estimated Competitive Price F.O.B. Plant, Miami	F.O.B. Plant Equivalent Price Paid at Ranch ^b	Difference	National Quarterly Average Differen- tial Adjusted for Miami By-Product Credit ^c
(dollars per 100 pounds liveweight)				
<u>1957</u>				
8/9	24.96	24.53	-0.43	-1.85
9/25	23.50	23.66	+0.16	-1.85
10/9	23.80	23.37	-0.43	-1.41
10/26	24.08	23.66	-0.42	-1.41
11/14	24.66	23.66	-1.00	-1.41
11/22	23.80	23.66	-0.14	-1.41
12/12	24.96	23.66	-1.30	-1.41
12/30	25.97	24.82	-1.15	-1.41
<u>1958</u>				
1/8	26.12	25.11	-1.01	-1.27

^aCarcass prices paid at ranch have been converted to a live-weight equivalent based on 58 per cent yield.

^bPrice paid at ranch plus allowance for trucking to plant.

^cSee column 4, Table 9.

F.O.B. plant. However, if the F.O.B. plant equivalent of these prices paid at the ranch had been less than the lows of the reported F.O.B. plant prices, the validity of those market report quotations would be questionable. Perhaps the nine observations suggest that the yield of these cattle sold at the ranch was somewhat higher than the yield of the cattle on which the lower price quotation was based.

Prices of U. S. Good grade.---The lows of the price ranges for U. S. Good reported at Miami compare much more favorably with their estimated competitive levels than did the prices for U. S. Choice (Fig. 6). During the period observed the price quotations for U. S. Good steers generally exceeded their estimated competitive levels (Table 11). Consequently, the problem of deciding whether or not a deficit between estimated competitive price and quoted price is justifiable does not arise. Furthermore, data on marketing margins and price differences based on national averages are not compiled for U. S. Good. Thus, any differences at Miami between the prices of U. S. Good steers and the live-price equivalents of the carcass prices cannot be compared with national averages for the corresponding periods of time.

Judging from the frequency of price reports on direct purchases of U. S. Good at Miami, this grade of cattle is available in South Florida at all times of the year. Regularity of supply may have some practical bearing on the bargaining position of producers who face an oligopsonistic outlet for their products. The knowledge that at

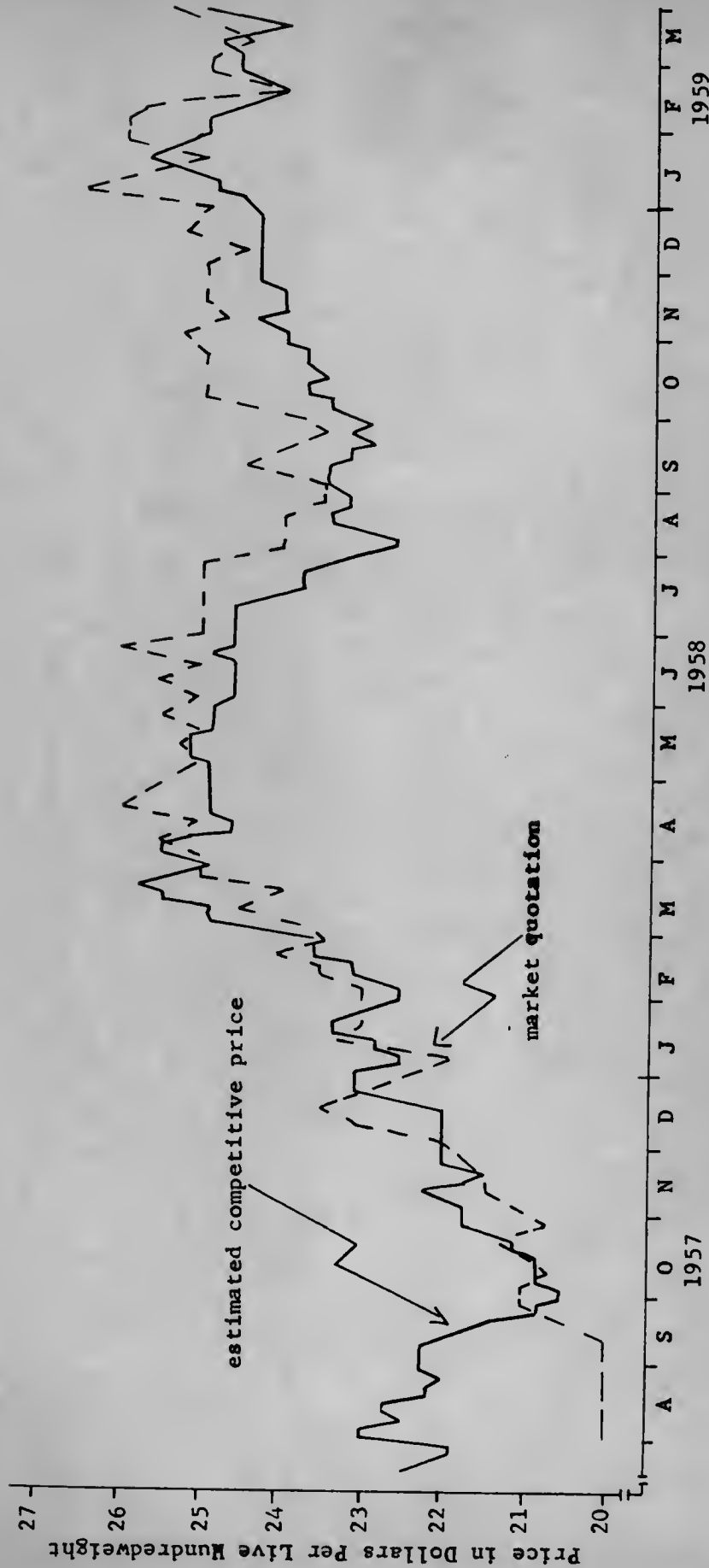


Fig. 6.--U. S. Good Steers at Miami: Estimated Competitive Price* F.O.B. Plant and Market News Price Quotation F.O.B. Plant, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to March, 1959.

*Estimated competitive price equals (carcass price at Chicago plus freight to Miami) $\left(\frac{56}{100}\right)$.

TABLE 11

DIFFERENTIALS BETWEEN SELECTED PRICES OF LIVE ANIMALS AND
LIVEWEIGHT EQUIVALENTS OF ESTIMATED COMPETITIVE PRICES
FOR CARCASSES U. S. GOOD STEERS,
AUGUST, 1957, TO DECEMBER, 1958

Week Includ- ing	Miami Live Price ^a Minus Estimated Competitive Price	Week Includ- ing	Miami Live Price ^a Minus Estimated Competitive Price	Week Includ- ing	Miami Live Price ^a Minus Estimated Competitive Price
(dollars per 100 pounds liveweight)					
8/1/57	-2.98	2/13	+0.39	7/17	+0.95
8/8	-2.42	2/20	+0.33	7/24	+1.23
9/5	-2.27	2/27	-0.17	7/31	+1.51
9/12	-1.99	3/6	-1.06	8/7	+1.35
9/19	-0.18	3/13	-0.39	8/21	+0.51
9/26	+0.13	3/20	-1.45	8/28	+0.29
10/3	+0.41	3/27	-0.17	9/4	+0.00
10/10	-0.12	4/3	-0.45	9/11	+1.00
10/17	+0.13	4/10	+0.33	9/18	+0.79
10/24	+0.10	4/17	+0.39	9/25	+0.29
10/31	-0.96	4/24	+1.11	10/2	+0.79
11/7	-0.71	5/1	+0.61	10/9	+0.51
11/14	-0.77	5/8	+0.61	10/16	+1.23
11/21	+0.07	5/15	+0.08	10/23	+1.23
12/5	+0.01	5/22	+0.11	10/30	+1.23
12/12	+1.01	5/29	+0.61	11/6	+1.20
12/19	+1.51	6/5	+0.39	11/13	+0.42
1/2/58	-0.61	6/12	+0.89	11/20	+0.95
1/9	-0.55	6/19	+0.39	11/27	+0.67
1/16	+0.42	6/26	+1.39	12/4	+0.67
1/23	-0.39	7/3	+0.39	12/11	+0.17
1/30	+0.17	7/10	+0.39	12/18	+0.92
2/6	+0.45				

^aSource: U. S. Department of Agriculture, Florida Department of Agriculture, Florida Weekly Livestock Market Summary, Vol. XXXX and XLI (Thomasville, Georgia: Mimeographed, 1957, 1958).

least some supply is available regularly might stimulate somewhat more effective competition among oligopsonists who are not in collusion.

The historical dominance of production of lower grade cattle in South Florida has meant that Miami packers have had to specialize in manufacturing processed meats. Wholesale meat buyers could not rely on these packers as sources of meat in the higher grades. When a packer slaughtered higher grade cattle he might have been in a position of having to find someone to "take the carcasses off his hands." Thus, from the wholesale buying level for meat all the way back to the cattle producer the prices could have been below competitive levels. This postulated situation might explain in part the low prices paid for U. S. Choice cattle in Miami.

On the other hand the more favorable prices of U. S. Good cattle at Miami suggest that most packers have developed outlets for this grade. The cyclical contraction of supply of even the dominant lower grade slaughter cattle during the period observed may have accelerated this development of broader outlets. As pointed out previously, the cyclical effect on supply definitely has forced packers to operate below their most profitable levels. This has resulted in more buyers bidding on U. S. Good cattle than in previous times.

Prices of other U. S. grades.—In contrast to the discovery of prices for higher grade cattle in Florida, the situation for price discovery of U. S. Standard and lower grades is that of production

in excess of consumption. Since there are no publicly available wholesale meat price quotations in Miami, it is impossible to evaluate the liveweight prices of lower grade cattle by comparing them with an equivalent of a carcass price. In this respect the competitive aspects of the lower grade cattle prices thus are indeterminate. However, from the discussion in Chapter III of the general cattle marketing situation in South Florida, it can be assumed that trading in lower grade cattle is reasonably competitive.

Prices Paid at the Belle Glade Auction

The problem of evaluating auction prices is identical to that encountered in evaluating prices of lower grade cattle at Miami packing plants. There is no wholesale meat price quotation on these grades, and the area of production is one of surplus instead of deficit. Prices of cattle in a surplus area would tend to equal the prices of meat in a deficit area minus the transfer costs. However, no attempt has been made in this analysis to derive estimates of the Miami wholesale prices of meat in the lower grades.

An evaluation of prices quoted F.O.B. plant Miami has been made in the preceding section. This set of prices provides a basis for evaluating the extent to which auction prices are competitive. The previous evaluation of the competitive level of plant prices can be applied to auction prices in a greater or lesser degree as suggested by the differences between the two sets of prices.

Auctions receive vigorous competition from direct selling of cattle and calves. Virtually all slaughter cattle and calves in grades above U. S. Standard are sold in direct sales (Table 12). After considering what it costs to sell animals through the auction, many producers in the area feel that prices received for cattle sold at the ranch yield a greater net return. Packers say they can pay more at the ranch than at the auction because losses due to bruising from handling are reduced.

On the other hand, the weight of an animal in the auction ring is likely to represent more shrink than does the weight of an animal weighed at the ranch. Packers allow for differences in shrink by paying more per pound liveweight for animals that have undergone greater shrinkage. In this respect auction prices would be expected to be higher than direct sale prices at the ranch.

In bypassing the auction, producers destroy a reliable indicator of market price. This in itself is no justification for perpetuating auctions, if in other respects they are less efficient than direct selling. On the other hand, direct selling does create the real problem of obtaining adequate knowledge of market conditions, and at the same time makes collusive practices more attractive to dubious operators.

The auction at Belle Glade serves all of South Florida. Some buyers attend from points north that are further away than Miami. Theoretically, packers located to the north of Belle Glade receive

TABLE 12

COMBINED RECEIPTS OF SLAUGHTER CATTLE AND CALVES AT
THIRTEEN FLORIDA AUCTIONS, PERCENTAGES BY
U. S. GRADES, 1956^a

U. S. Grade	Steers	Heifers	Cows	Bulls	Calves
	(per cent)				
Choice	0.3	—	—	—	.7
Good	6.2	2.4	—	.1	11.6
Standard and Commercial	29.8	15.4	1.3	4.1	36.4
Utility	39.3	38.3	19.2	27.6	40.1
Cutter	18.4	34.8	44.8	45.2	11.2 (cull)
Canner	6.0	9.1	34.7	23.0	—
Total	100.0	100.0	100.0	100.0	100.0
Total Number	28,020	20,498	48,542	11,084	80,397

^aSource: Florida State Marketing Bureau, Annual Agricultural Statistical Summary (Jacksonville 1, Florida: November, 1957), p. 177.

less for their meat by virtue of being closer to the surplus producing area than are Miami packers. Assuming a uniformity in packing plant operating costs, the more distant buyers can meet the price offers of less distant buyers only by taking smaller margins. On any sale day when less distant buyers have largely filled their needs by direct purchases, the more distant buyers can become the active bidders, and price will fall accordingly. Such events further discourage would-be consignors to the auction.

To examine whether or not the auction prices have been consistent with the price quotations F.O.B. plant Miami, the plant quotation will be used to derive equivalent prices at the Belle Glade auction. In the analysis these prices will be referred to as the Belle Glade equivalents.

First an allowance must be made for transportation from auction to plant. The Belle Glade auction is approximately eighty miles from Miami. Buyers can haul live cattle eighty miles at an estimated thirteen cents per hundredweight.⁸⁷ Therefore the Belle Glade auction price might be expected to be at least thirteen cents below the price F.O.B. plant.

Deductions must also be made for bruising, the risk of crippling or death from handling at the auction, and for any additional

⁸⁷Assume a forty-foot trailer hauls thirty 1,000 pound animals at twenty-five cents per mile round trip.

in-transit shrink from auction to plant.⁸⁸ It is assumed in the analysis that 3 per cent of the price F.O.B. plant will cover these deductions.

A price at the Belle Glade auction lower than the Belle Glade equivalent of the price F.O.B. plant might suggest a sale day dominated by more distant buyers. An auction price equal to or greater than the Belle Glade equivalent would indicate active participation by Miami buyers at the sale.

Over a thirteen-month period beginning in September, 1957, the several price reports for U. S. Good steers sold at weekly auction sales in Belle Glade fluctuated both above and below the Belle Glade equivalent.⁸⁹ U. S. Good steers were sold at the auction on only twenty-one sale days, during the period, and often only a small quantity was consigned. However, they constitute the only price comparisons available in this grade. Auction prices for the few months observed in 1957 were below the Belle Glade equivalent while in 1958 they remained generally above (Fig. 7).

⁸⁸The price F.O.B. plant is paid for animals that have undergone in-transit shrinkage before being weighed in at the plant. Similarly, the packer's bid at auction is paid for animals that have undergone in-transit and handling shrinkage before being weighed at the sales ring. Assuming the shrinkage is equal in both instances, this factor is not considered in the derivation of the auction price.

⁸⁹Again the lows of the price ranges are used in the comparison because it seems reasonable to expect that any two low-price quotations are more likely to represent comparable cattle than are two high-price quotations. It would be a rare situation, particularly in Florida, to find all the animals in a grade clustered at the upper end of the grade. Clustering at the lower end would be likely to occur more often.

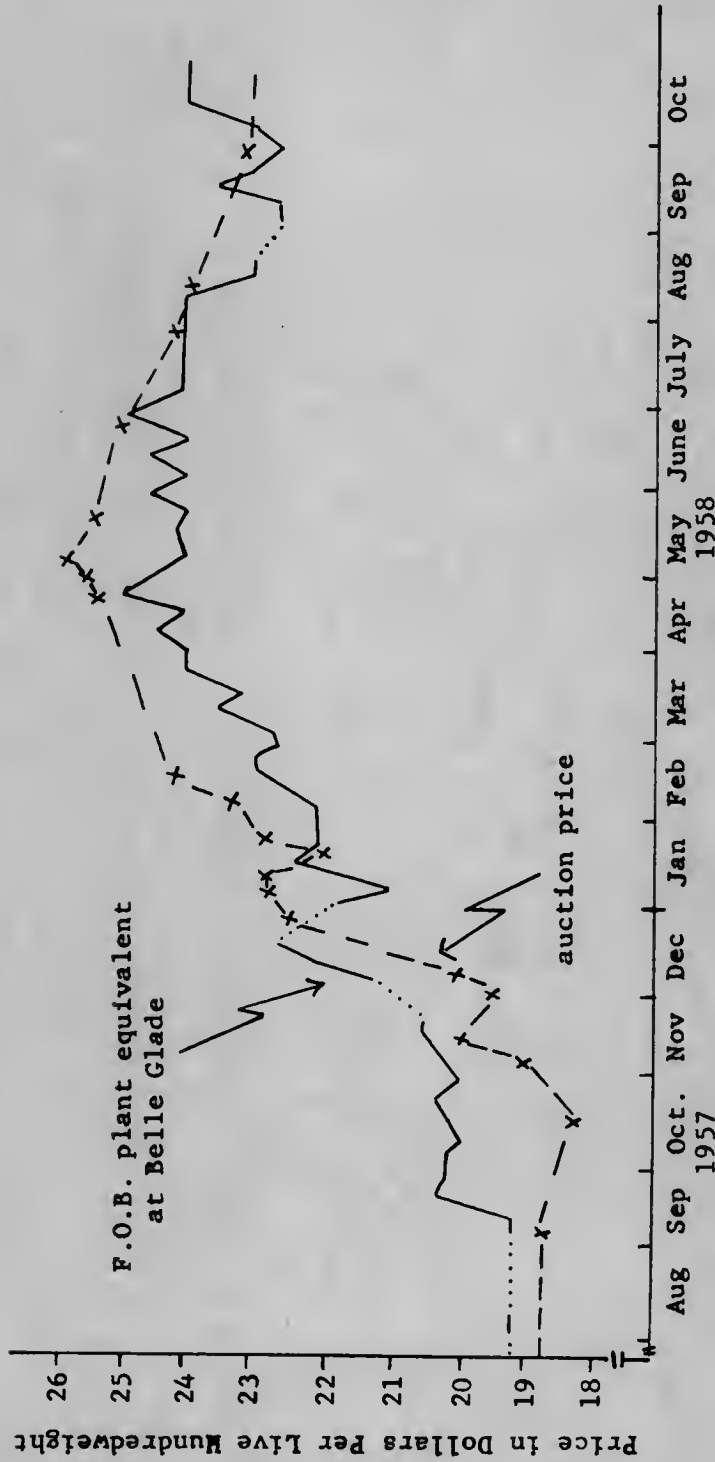


Fig. 7.--U. S. Good Steers at Belle Glade: Direct Sale Prices F.O.B. Miami Adjusted to their Equivalent at Belle Glade, and Belle Glade Auction Prices, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to October, 1958.

If the prices in this comparison are reasonably close approximations of the situation that existed for U. S. Good in the period observed, there are indications that in the last four months of 1957 price depressing agents were active at the auction. Producers who during these months could have delivered U. S. Good cattle to the packing plant at lower transfer costs than those incurred by selling through auction would have received greater net returns.

On the other hand, in the first nine months of 1958 apparently Miami buyers were active participants at the sales. Furthermore, the data indicate that in this period prices paid at auction were generally higher than comparable prices at Miami plants. Cattle producers whose costs of transfer to and selling through the auction were less than the costs of transfer from farm to packing plant would have received greater net returns from auction prices.

For the full thirteen month period, prices of U. S. Standard steers at auction were consistently above the Belle Glade equivalents (Fig. 8). The majority of U. S. Utility auction prices observed in the four months of 1957 were below the Belle Glade equivalents, although the F.O.B. quotations fluctuated more widely (Fig. 9). In 1958 with few exceptions U. S. Utility at auction was generally at a level somewhat above the Belle Glade equivalents (Fig. 9). Auction prices of U. S. Canner and Cutter cows during the period were almost always below Belle Glade equivalents, with the spread widening considerably in the first nine months of 1958 (Fig. 10). With U. S.

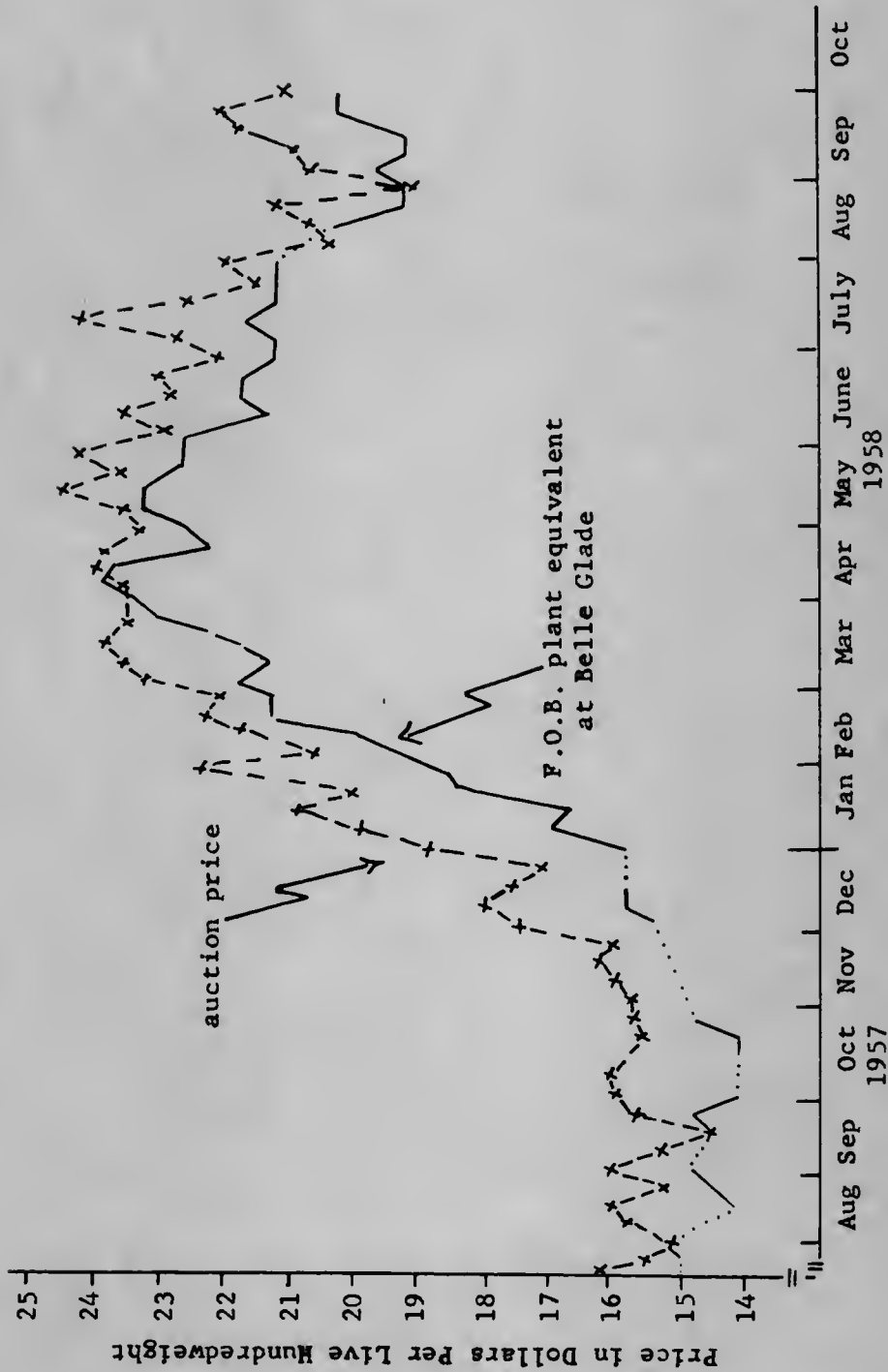


Fig. 8.--U. S. Standard Steers at Belle Glade: Direct Sale Prices F.O.B. Miami Adjusted to their Equivalent at Belle Glade, and Belle Glade Auction Prices, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to October, 1958.

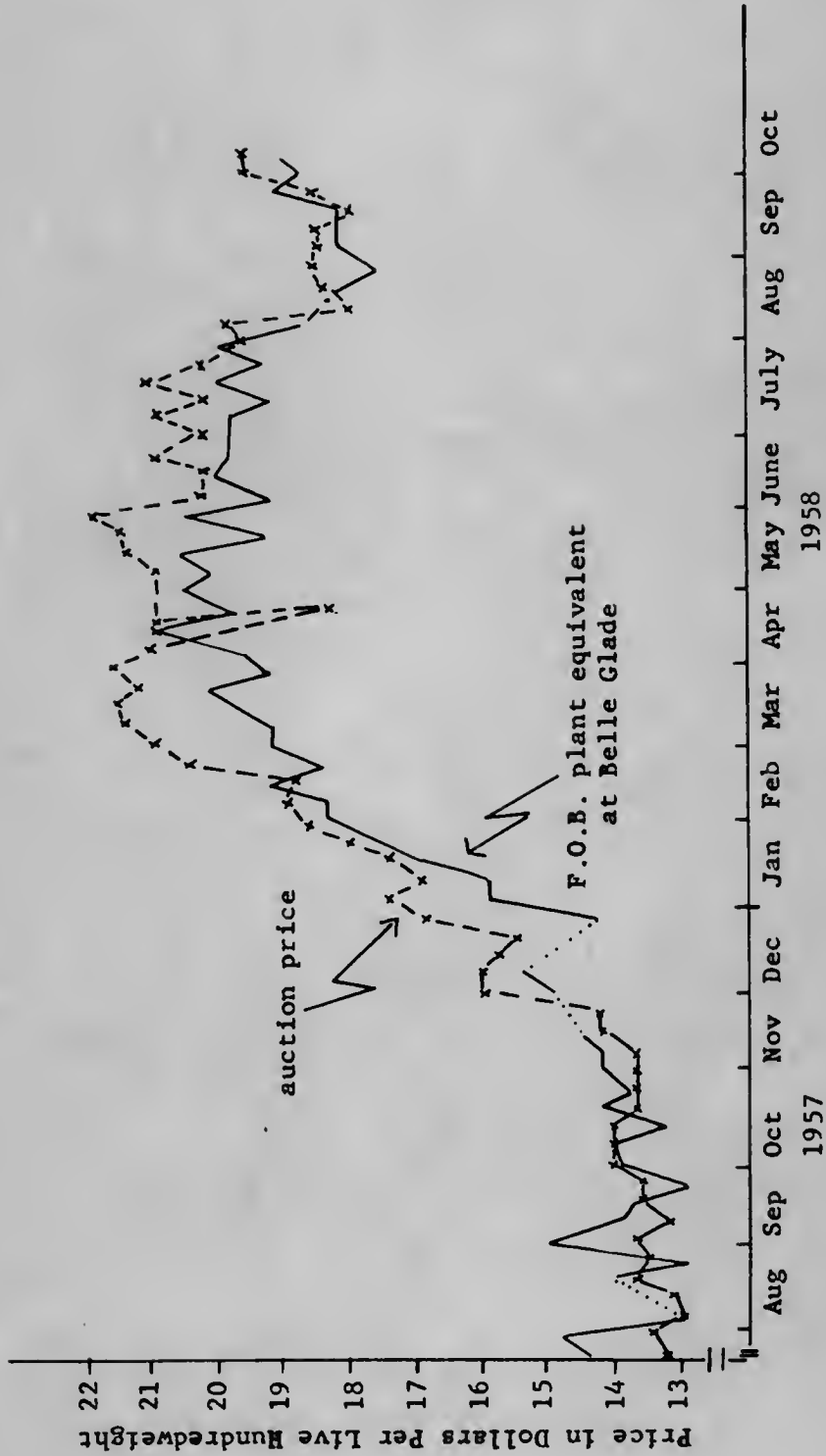


Fig. 9.--U. S. Utility Steers at Belle Glade: Direct Sale Prices F.O.B. Miami Adjusted to their Equivalent at Belle Glade, and Belle Glade Auction Prices, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to October, 1958.

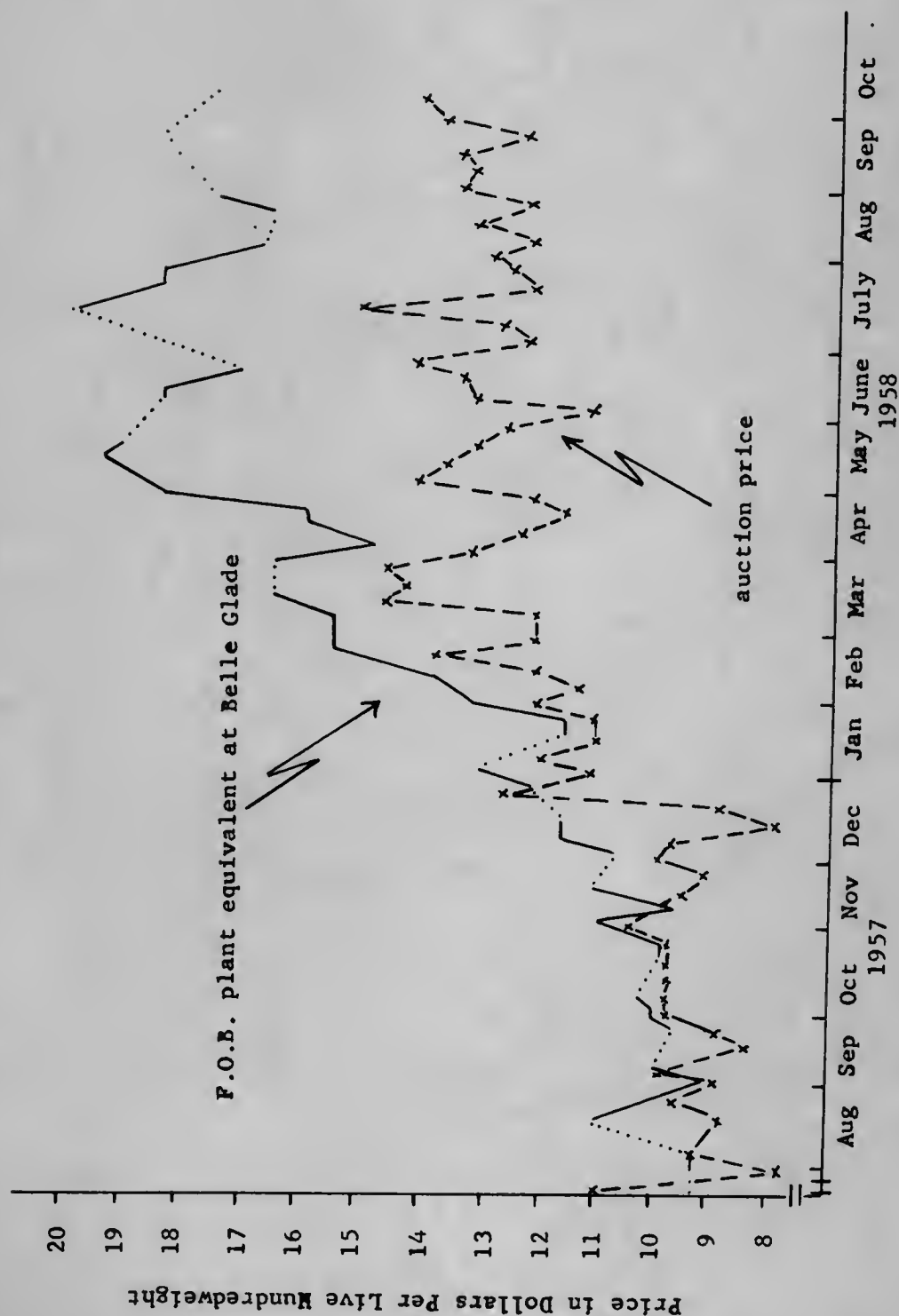


Fig. 10.--U. S. Canner-Cutter Cows at Belle Glade: Direct Sale Prices F.O.B. Miami Adjusted to their Equivalent at Belle Glade, and Belle Glade Auction Prices, the Low of the Price Range Reported, in Dollars Per Live Hundredweight, August, 1957, to October, 1958.

Canner and Cutter cows, factors depressing the auction prices to levels far below the equivalent prices F.O.B. plant were particularly strong in 1958. This would not be unusual if the more distant buyers gained a larger share of the market as local buyers became less active. The more favorable prices quoted by direct sale buyers of low grade cows may represent highly selective and limited buying on their part.

The comparisons in general indicate that prices paid at auction maintained some comparative advantage over equivalent prices paid F.O.B. plant in the U. S. Standard and Utility steer grades (and in U. S. Good steers, if the price quotations are representative). However, this does not mean that producers necessarily would have greater net returns when selling through the auction. To arrive at a net farm price a producer must deduct from the auction price the costs of transfer from farm to auction, the sales commission, and any handling or yardage charges. This net farm price can then be compared with the direct sale price F.O.B. farm to determine which method of sale is more advantageous.

Because direct sale quotations were initiated at Miami late in 1957 there is no long-term evidence of the auction vs. direct sale relationship. Contrary to the opinion expressed by many producers, direct sales do not always yield a net return greater than an auction sale. A decision as to which method yields greater returns can be made only after comparing accurate price quotations and costs of marketing. It may be that in comparing their prices with auction

prices, direct sale sellers are not comparing comparable cattle. On the other hand, the direct sale buyer may feel it is to his advantage to understate his prices for market news publications. Then when his offer to a seller is somewhat above the reported price, he may have some temporary advantage in gaining the sale.

Understating prices could not be accomplished market wide without collusion. Although the number of buying firms in South Florida is relatively small, this type of collusion among them seems rather unlikely. But if in any reporting period only a few of the firms actually give price quotations to the market reporters, the market-wide price is not representative. Basing price comparisons on inaccurate and non-representative information can lead only to erroneous conclusions.

CHAPTER VI

IMPLICATIONS

Economic Significance of Price Differences

The word significance is a fine example of ambiguity in meaning. However, for purposes of this discussion a variable is considered economically significant when changes in its values cause marketing decisions to be made differently in those particular segments of the economy observed. Marketing decisions are made in the production, distribution, and consumption segments of the economy.

On a per pound basis, concern over a one cent difference in price seems trivial. Price differences that are small in monetary measure become magnified to significant levels when the units of product traded are large, for example, a one thousand pound animal or a six hundred pound carcass. For a one thousand pound animal a difference of one cent per pound amounts to ten dollars. In pricing cattle and meat on a per pound basis, even halves and quarters of cents are important. Consequently in the segments of production and distribution, price differences of any magnitude may have at least some degree of economic significance.

Of course if unpredictable circumstances have brought forth selling prices yielding windfall profits, two or three dollars per animal might not cause a cattleman to exert much effort in seeking out

the highest bidder. National emergencies occurring without warning, such as the Korean conflict, or severe weather conditions are examples that come to mind. But such cases are rare. Ordinarily a difference of two dollars per animal or per carcass is more than sufficient to affect the marketing decisions of buyers and sellers.

Small differences in price probably are more influential in a cattleman's decisions of when and where or to whom to sell than in his decisions of what and how much to produce. This is true because of the time element involved. Increasing cattle production is a long-term proposition for which cattle prices have to be estimated well into the future. On the other hand once the animals have been produced, and sale of them is contemplated, the future is much closer at hand. Price estimation or prediction over short periods of time can be handled with more confidence, thus smaller price differences can be considered. When circumstances bring the time of sale extremely close at hand, price becomes more of a certainty.

Insofar as the meat packing business is reputed to operate at small margins per animal unit of output, packers too will show concern over small differences in prices.

Most market reports on livestock and meat transactions quote prices to the nearest quarter of a dollar per hundredweight. Using this as the criterion, differences of twenty-five cents or more per hundredweight will be considered economically significant. Under such an assumption, it is implied that differences of at least a quarter

of a dollar per hundredweight will have an observable effect upon marketing decisions. Thus, whenever an observed price per hundredweight falls below its expected level by twenty-five cents or more, it is considered evidence of impediments in pricing efficiency.

Pricing efficiency is variously defined as how well the price of a product at some point in the marketing system is reflected back through the marketing channels to the producer, after due allowances are made for marketing costs. In essence the price at the point of observation is taken as given and the marketing costs are evaluated on the basis of acceptable and justifiable criteria.

The data presented in Chapter V clearly show that pricing efficiency for U. S. Choice steers was impaired on numerous occasions (Fig. 5 and Table 9). The price quotations F.O.B. plant for this grade were frequently below their expected levels by more than twenty-five cents per hundredweight from August, 1957, until May, 1958. For the remainder of 1958 the prices F.O.B. plant for U. S. Choice steers were within the limits acceptable under the previous assumptions.

The inefficiency observed in prices of U. S. Choice steers may well be related to the relatively small volume of fed cattle produced in South Florida. As long as fed cattle are produced in the area only sporadically, packers will not look to local producers as dependable sources of supply. With chain stores now contracting for meat supplies several weeks or more in advance, the emphasis is shifting toward some form of orderly marketing of livestock. Until South Florida becomes a

dependable, although minor, source of Choice cattle, producers in the area probably cannot expect to receive the full price advantage of location nearest the market center.

Instances in which prices of U. S. Good steers at Miami moved below estimated competitive levels were not frequent enough to question pricing efficiency. Occasional price deficiencies may result from temporary marketing impediments of a local nature that do not reflect the failure of spatial equalization in prices.

Careful attention to breeding, better herd management, and supplemental feeding on improved pastures have demonstrated that the grade of primarily grass-fed cattle can be raised. Progressive cattlemen are marketing U. S. Good cattle in South Florida. The regularity of price reports on direct purchases of U. S. Good cattle indicate that the supply is regular. At the same time the quantity is likely to be relatively small. Nevertheless, prices of U. S. Good did attain their conceptual levels. Orderly and regular marketing can help to build a competitive atmosphere into an existing marketing situation.

Problems Uncovered—Research Needed

Perhaps the greatest value of research of this kind is in the light it sheds upon the broader problem from which it was abstracted. This is precisely why researchers delineate and restrict the area of investigation to be considered in any one study.

In the process of exploring the ramifications associated with inefficiency in pricing higher grade cattle, the cattle marketing net-

work was found lacking in several respects. In the first place the manner in which prices in direct sales are reported from the several market centers make comparisons difficult if not impossible. Prices reported for mixed grades are not very informative. Homogeneous grades facilitate price reporting and comparison. The only other source of public information on prices is auctions where according to a recent survey packers buy only 45 per cent of their cattle and calves for slaughter.⁹⁰ The usefulness of the auction price as a thermometer of market price prevailing is somewhat doubtful. At the direct sale level, it is necessary to consistently report prices by individual grades if the price information is to be more useful to producers.

Secondly, the absence of a market report on wholesale prices of carcasses and primal cuts for the Southeast generally and Miami particularly, means that producers cannot make well-informed evaluations of the live animal prices they receive. Their opinions are formed upon hearsay or upon their interpretation of local retail prices of meat. Such information is grossly misleading. The operation of a more competitive situation for marketing livestock in South Florida definitely is impaired through the lack of a realistic wholesale meat price quotation based on trading in the Southeast.

Thirdly, the results of the exploratory grading trial at Belle Glade are concrete evidence of variations among the abilities of men

⁹⁰Florida State Marketing Bureau, Annual Agricultural Statistical Summary (Jacksonville, Florida: November, 1958), p. 185.

to judge and estimate grades of steers (Appendix I). Although other classes of cattle were not in the trial lots, there is no reason to believe that these men would have performed any better on cows, heifers, or calves. Assuming the live-graders observed had more well-rounded grading experience than most cattle producers, one might expect the grading performances of cattlemen to show wider variations.⁹¹ Wide variation in live-grading would place cattlemen at a distinct disadvantage in the bargaining transaction between buyer and seller. Admittedly, there are some cattlemen whose live-grading is fully as proficient as professional buyers. Further study among buyers and sellers is needed to compare their competitive bargaining strengths due to differences in abilities to judge the grades of cattle.

If attention is focused on the actual conduct of a grading trial, there is much research needed to develop an experimental design best adapted to the measurement and analysis of grading errors.

Finally the problem of utilization of byproducts by the packing industry in South Florida should be analyzed thoroughly and a practical solution proposed.

⁹¹The live-graders observed in the trial had previous opportunities to check their own accuracies by following animals through to the cooler. Although packers say producer customers are free to do this, the practice is not generally followed. Indeed, to do so may seem impractical for many cattlemen, but actually such a move would strengthen their bargaining position through improving their live-grading.

CHAPTER VII

SUMMARY, CONCLUSIONS AND CONJECTURES⁹²

The marketing of livestock, particularly cattle, in Florida has exhibited a change in that direct selling of animals at the farm or ranch is gaining dominance. By moving the point of sale back to the place of origin of the product, some savings in marketing costs have occurred. But accompanying these cost reductions is a complication in the availability of adequate information on market prices and quantities. Prices at physical market centers such as auctions or terminals no longer reflect the full range of quality or the larger proportion of animals traded. To overcome this deficiency Florida packers were asked by the State Marketing Bureau to report for publication weekly the quantities, grades, and range of prices paid on their direct purchases. This venture has been partially successful since 1956.

In South Florida the combination of agricultural and urban development, influenced by geographical and climatic features, has brought about a marketing situation for livestock in which non-competitive trading could easily exist. This study was undertaken in

⁹²To "conjecture" is to base an opinion or judgment upon what is recognized as insufficient evidence. Probably more "conclusions" belong in this category than researchers are willing to admit.

an effort to estimate the degree of competition among buyers and sellers of cattle slaughtered in the greater Miami area. A model of pure competition was chosen as the standard for purposes of analysis.

In a reasonably competitive marketing situation, it was assumed that the wholesale carcass price received by packers would be reflected back to the producer, after deducting allowances for marketing costs. How well the marketing system accomplished this reflection was termed a measure of pricing efficiency. The analysis employed the wholesale price of carcasses at Chicago plus freight charges to Miami as an estimate of the Miami wholesale carcass price. Allowances were made for the net difference between byproduct credits and the packer's cost of procuring animals, slaughtering them, and selling the carcasses. All carcass prices were converted to their equivalent prices for live animal weight using assumed dress-out percentages. In this manner was established a conceptual price for live animals, F.O.B. plant Miami, that cattlemen would be expected to receive under reasonably competitive marketing conditions.

Prices paid F.O.B. plant Miami as quoted by packers were obtained from published market reports. Because of the restrictive nature of available price data, comparisons could be made only on U. S. Choice and U. S. Good steers. A limited amount of price data was obtained from producers who had sold cattle direct to packers on a carcass grade and weight basis. These prices actually paid for cattle were compared with the estimated competitive prices. When the

actual price fell below the estimated competitive price by twenty-five cents or more per hundredweight, this was considered an impediment in pricing efficiency. Furthermore, it was considered to reflect the existence of imperfectly competitive conditions in the marketing system. Such conditions apparently prevailed for U. S. Choice steers from August, 1957, until May, 1958, and on a few occasions between May, 1958, and March, 1959. On the other hand, for U. S. Good steers indications of imperfectly competitive pricing were not observed with any regularity, but only for an occasional week or two prior to April, 1958.

With the exception of price controls and compulsory meat grading during national emergencies, the livestock industry has been relatively free from rather direct government participation in marketing. Federal legislation in the Packers and Stockyards Act does provide a code of business ethics for those firms under its jurisdiction. Certainly it cannot be concluded that the only solution to correcting the ills of livestock marketing conditions lies in government administered pricing. On the other hand, the market does contain the basic elements of oligopsony.

The grading trial points to a source of imbalance in bargaining power which may be rendered ineffective or less effective by sellers' efforts to improve their judgment of quality in cattle. This is just as important when they are selecting animals to haul to auction as when they are matching wits and abilities with direct sale buyers at

the farm. In addition, keeping abreast of current market prices is essential to the strength of a producer's bargaining position. A market report of wholesale prices of carcasses and cuts representing trading in the Southeast would be in the direction of satisfying the purely competitive concept of common knowledge among buyers and sellers regarding prevailing market conditions.

Commentators inevitably suggest orderly marketing as a device producers could use to stabilize supply and its price.⁹³ Orderly marketing can also act to discourage the development of situations where non-competitive trading might otherwise arise. However, controlled supply requires concerted efforts by producers. To this end producers of some agricultural commodities have called upon government to issue and supervise marketing agreements and marketing orders.

Before resorting to other methods of securing and maintaining a bargaining position equal to the buyers of their products, cattle producers can (1) improve their proficiency to estimate the grades of live animals, (2) become better informed on the marketing situation in their areas, and (3) consider all possible alternatives in deciding when and where to sell.

⁹³There are several viewpoints as to what orderly marketing is, and what it can accomplish. Cf. F. V. Waugh, Readings on Agricultural Marketing (Ames, Iowa: The Iowa State College Press, 1954), pp. 145, 147, 337, 359, 382.

APPENDIX

STATISTICAL COMPARISON OF ERRORS-OF-ESTIMATE⁹⁴

The analysis of variance technique⁹⁵ may be used to compare errors-of-estimate made by one live-grader with those made by one or more other live-graders on the same lot of animals.

Two or more men may be equally proficient live-graders, yet on a single lot of animals their mean errors-of-estimate very likely will be arithmetically different. A statistical test can produce evidence supporting statements of how likely was the chance occurrence of an observed arithmetical difference. If, after the calculations are made, the differences between the mean errors-of-estimate of the live-graders could occur by chance alone very rarely, say one time in a thousand, the analyst would conclude that very likely the means came from different populations. It follows that very likely there would be a real difference between the grading abilities of the men. But if the probability of the differences occurring by chance alone was say eighty times in two hundred, the analyst would conclude that very likely there were no real differences between the grading abilities of the men. The results of statistical testing are interpreted only in a probability sense, never with certainty.

⁹⁴This analysis is a further treatment of a portion of the data presented in the manuscript by W. K. McPherson, et al., op. cit. The writer of this dissertation is a co-author of the manuscript.

⁹⁵G. W. Snedecor, Statistical Methods (5th ed., Ames: The Iowa State College Press, 1956, pp. 237-238.

To illustrate the type of analysis followed, the examples will use data from the group of men who graded live animals at Belle Glade in 1957. The nature of the data confine the analysis to a discussion of the performance of the five men observed. The type of calculations employed may be applied to other groups as well. The reader is cautioned to keep in mind the fact that neither the animals graded nor the graders in this preliminary investigation were randomly selected as representative samples of specified populations, nor was there a designed experiment conducted. The presentation of a method of inferential analysis is for the purpose of showing what can be done in this area when suitable data are developed in an extensive experimental design.

Although no pre-determined design was used, the actual grading procedure did approximate that in a randomized complete block design. An analogy to agronomic experiments requires modification. The usual plot response to treatment is replaced by the estimated animal grade as reflected through the treatment material, i.e., the grader. Ordinarily, measurements on the treatment material itself would not or could not be taken. The graders are considered as the treatment material. Each animal constitutes a block. Since in a block each grader graded the same animal, the block contains identical experimental units. Because of this unique feature, randomization of treatments within blocks is not necessary.

Response to treatment may be indicated in each plot by the

actual score or estimate made by a particular grader on a particular animal.⁹⁶ Response also may be indicated by showing in each plot the difference between an estimated grade and the official carcass grade designated after slaughter. This difference is an error-of-estimate and is assumed to be a random variable. Assuming that the data were generated in a randomized complete block design, the errors-of-estimate observed may be considered to be made up of several components. In the model of the block design, a single difference or error-of-estimate, call it d_{ij} or $X_{ij} - Y_j$, has at least three components that may be symbolized by α , β and ϵ :⁹⁷

$$(4) \quad X_{ij} - Y_j + d_{ij} = \mu + \alpha_i + \beta_j + \epsilon_{ij},^{98}$$

⁹⁶In the grading procedure, the live-graders used arithmetic numbers ranging from 3 to 17 to indicate grade:

3 - Canner	8 - High Standard	13 - Mid Choice
4 - Cutter	9 - Low Good	14 - High Choice
5 - Utility	10 - Mid Good	15 - Low Prime
6 - Low Standard	11 - High Good	16 - Mid Prime
7 - Mid Standard	12 - Low Choice	17 - High Prime

⁹⁷Snedecor, op. cit., 5th ed., p. 296.

⁹⁸For purposes of analysis, it is further assumed that live-graders attempt to estimate not the true grade of the carcass, but the grade which the federal meat-grader will place on the carcass. This grade, that is the grade designated by the federal meat grader, is known for certain and contains no error as far as the market pricing procedure is concerned. It can be argued that since the meat grader makes errors in judgment, a difference based on his designation of grade penalizes the live-grader. If it is assumed that both the meat grader and the live grader attempt to estimate the true grade of a carcass (which in terms of the present subjective specifications is indeterminate), the meat grader's error is truly confounded with the live-grader's error. However, a test of significance can also be applied to differences in the actual estimates among live-graders, thus avoiding the error controversy.

where:

X_{ij} = the i^{th} grader's estimate on the j^{th} animal;

Y_j = the official carcass grade of the j^{th} animal;

μ = the over-all mean of the errors of estimate from which the α_i deviations are measured;

α_i = a deviation or bias of the i^{th} grader associated with all animals in the group (the treatment effect);

β_j = an effect associated with a particular animal, the j^{th} animal, and its estimate by all graders (the replication or block effect);

ϵ_{ij} = a random error of the i^{th} grader on the j^{th} animal, and associated with unexplained and uncontrolled factors (sampling variation).

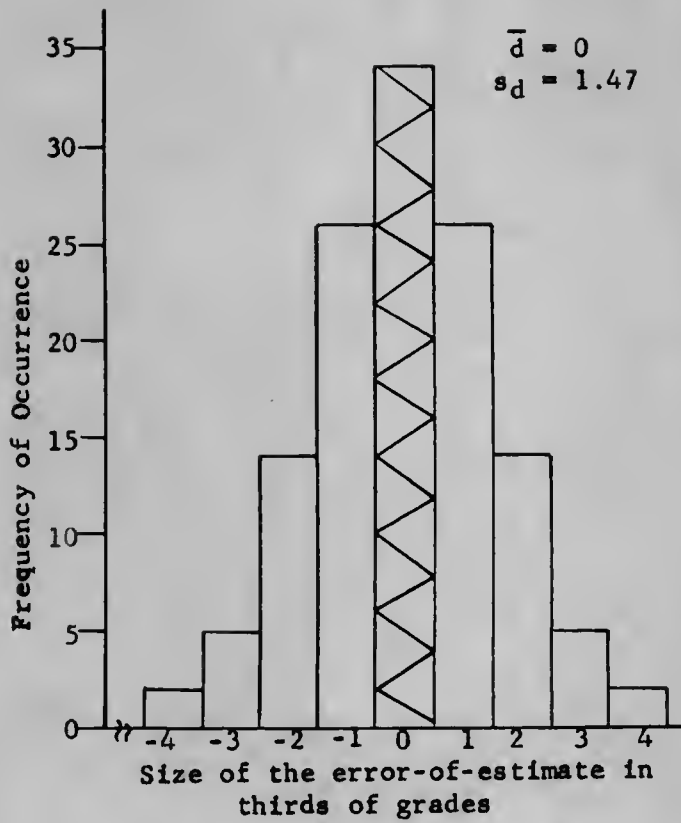
There may be some difficulty in reasoning how conceptually an element of chance might enter a live-grader's error-of-estimate. It might seem as if any degree of error in the estimate is due entirely to human frailty, but there are some factors, call them environmental factors, over which a live-grader has no practical control regardless of how accurate is his basic ability to judge quality of cattle. These environmental influences will cause him to miss the grade simply because in practice he cannot compensate for their effect. Yet, since an error-of-estimate can be observed only as a single quantity, it is rather tempting to attribute all of the error to a failure in human judgment. The person grading cattle passing quickly through the sales ring at an auction experiences different environmental effects than he would grading at the ranch.

On the other hand, in a controlled experiment, it might be

possible to control the environmental factors to an extent where virtually no chance element could operate. In this ideal situation any error in a live-grader's estimate would be due to something besides chance. In effect any error-of-estimate in such experiments is significant because there is no estimate of chance error against which observed error may be compared.

Probably no man can become a perfect live-grader, that is, have 100 per cent accuracy. A proficient live-grader has perfected his ability to estimate carcass grade to the point where he can make allowances for variation in environmental conditions and animal characteristics, within the limits of human observation. It is assumed that the variation in conditions and characteristics for which the proficient live-grader cannot make conscious allowances will affect his performance in a random fashion, and thus cause the population of his errors-of-estimate to be symmetrically distributed in some discrete approximation of normality (Appendix Fig. 1).⁹⁹ Populations of errors-of-estimate that are discrete approximations of normality, but are distributed around mean values other than zero may be characteristic of less proficient live-graders. Mean values other than zero indicate biased estimates of designated carcass grades. Less proficient live-graders will also have distributions with comparatively wide standard deviations.

⁹⁹See footnote 72, P. 53, regarding normal approximation.



Appendix Fig. 1.--A Symmetrical Distribution of Errors-of-Estimate by Thirds of U. S. Grades, for a Hypothetical Grader, with Theoretical Frequencies Derived by Fitting a Normal Curve to a Set of 119 Observations Having An Assumed Mean and Variance.

Since the data were generated from an approximate randomized complete block design, double-classification analysis of variance was used.^{100, 101} The analysis of variance of the composite of all the errors-of-estimate for all five live-graders detected the same significant differences whether the data were expressed as actual estimates or error-of-estimate (Appendix Table 1). Duncan's Multiple Range Test¹⁰² places the live-graders in three separate classes: 2, 3, and 5 are in one non-significant difference group, while live-graders 1 and 4 each stand by themselves alone.

Another approach to an aggregate analysis of the data is suggested if it is assumed that the mean and variance of the distribution of the 128 official carcass grades are the parameters of an approximately normal distribution.¹⁰³ Thus, the distribution of the estimates of these 128 grades by a perfect grader would be essentially

¹⁰⁰Snedecor, op. cit., 5th ed., pp. 291-304.

¹⁰¹Dr. A. E. Brandt, Florida Agricultural Experiment Stations, has suggested a modified analysis of variance using multi-classification that would estimate several degrees of interaction between the variables. However, the author feels that the practical interpretation of differences in errors-of-estimate among breeds and among grades may be somewhat clearer using the analysis presented in this Appendix.

¹⁰²D. B. Duncan, "Multiple Range and Multiple F Tests," Biometrics, XI (March, 1955), pp. 1-42.

¹⁰³The distribution of these particular 128 carcass grades happens, by chance to be essentially normal with mean 8.81 and variance 3.82. A test of goodness of fit of a normal distribution to the 128 grades produces a χ^2 value with a 4.3 per cent probability. Cf. F. C. Mills, Statistical Methods (3d. ed.; New York: Henry Holt and Co., 1955), pp. 532-539.

APPENDIX TABLE 1

ANALYSES OF VARIANCE OF THE ACTUAL ESTIMATES AND THE ERRORS
OF ESTIMATE, AND THE ASSOCIATED DUNCAN'S TEST^a
FOR 128 STEERS, BY FIVE LIVE-GRADERS

Source	d. f.	Sum of Squares	Mean Square	Duncan's Test of Differences Among Grader's Means				
Actual Estimates								
Blocks (animals)	127	2,210.38	17.40	4	1	<u>5</u>	<u>3</u>	<u>2</u> ^{b,c}
Treatments (graders)	4	32.92	8.23**	4	1	<u>5</u>	<u>3</u>	
Error	508	287.08	.57	4	1	5		
Total	639	2,530.38		4	1			
Errors of Estimate								
Blocks (animals)	127	745.80	5.87	4	1	<u>5</u>	<u>3</u>	<u>2</u>
Treatments (graders)	4	33.61	8.40**	4	1	<u>5</u>	<u>3</u>	
Error	508	319.59	.63	4	1	5		
Total	639	1,099.00		4	1			

**Significant at the 1 per cent level.

^aD. B. Duncan, op. cit.

^bAny two means underscored by the same line are not significantly different. Any two means not underscored by the same line are significantly different at the 5 per cent level of probability, EXCEPT if the two means are both contained in a subset of the means which has a non-significant range, the difference cannot be declared significant.

^cThe numbers refer to graders 1, 2, 3, 4, and 5.

normal, with mean 8.81 and variance 3.82. If the distributions of the estimates of each grader are considered samples of an approximately normal population, their sample statistics can be tested against the parameters 8.81 and 3.82. This is a test of the hypothesis $\bar{X} - \mu = 0$, where both σ and μ are known. The reasoning employs a broader population concept in asking what is the probability of possible deviations of samples drawn from the postulated population?

Standard errors describing the sampling distribution¹⁰⁴ of means and standard deviations for samples size n can be calculated from the parameter $\sigma^2 = 3.82$. The variance of the mean is $\frac{\sigma^2}{n}$ and for standard deviation is $\frac{\sigma^2}{2n}$. The mean and standard deviation of a grader's estimates are evaluated by observing where they fall under the appropriate sampling distribution curves. For samples size 128 the percentage points of the sampling distribution curve are obtained from the "t" table.¹⁰⁵ Values falling under the tails at points corresponding to small percentages are judged significantly different from the parameter. Such values cast doubt on a live-grader's ability.

In the case of the lot of 128 steers, the mean estimates of all five graders were significantly different from μ , but only one grader's standard deviation was significantly different from σ . This suggests that the differences between the mean of the carcass grades

¹⁰⁴Mills, op. cit., 178-180.

¹⁰⁵Snedecor, op. cit., 46.

and the mean of each grader's estimates are due to something more than sampling error.¹⁰⁶ The practical interpretation of these tests results would conclude that the biases of the live-graders' estimates were so great that the live-animal grades appear to describe a different lot of cattle than the lot whose carcasses actually were graded. Incompetence among the live-graders would be strongly suspected.

The suspicion of incompetence may be reinforced if the analysis of variance described previously is expanded to include the meat grader's performance. It can be argued that if in fact the meat grader is making errors in his designation of the carcass grades, his performance should be considered along with the live-graders. This argument is based on the assumption that both the meat grader and the live-graders are estimating the true (but indeterminate) carcass grade. Therefore, as far as the interpretation of statistical tests is concerned, the meat grader's performance is just another sample, even though he looked at the carcass instead of the live animal. The analysis tests the hypothesis that all six samples come from the same population of estimates. When applied to the six samples the analysis of variance and associated Duncan's test revealed the meat grader's estimates to be significantly different, at the 5 per cent level,

¹⁰⁶When the estimates of each grader were paired with their corresponding carcass grades, animal by animal over all 128 steers, the paired "t" test also indicated highly significant differences. However, the data do not fit the assumptions of the paired "t" test. Cf. Bernard Ostle, Statistics in Research (Ames: Iowa State College Press, 1954), pp. 93-106.

from those of all five live-graders. The test also separated the five live-graders into three groups, as summarized previously (Appendix Table 1). The meat grader's estimates appear to belong to a population of estimates different from those of the live-graders and the live-grader's estimates appear to belong to three separate populations. While the test results can suggest incompetence among the five live-graders, the same test, assuming six of the same kind of samples were observed, also can suggest the incompetence of the meat grader.

Previously by the "t" test (page 108) each live-grader's mean estimate tested significantly different from the mean of the carcass grades (treated as a parameter). This together with Duncan's test now suggests that when the live-grader's estimates are viewed over the lot as a whole, the estimates seem to have been drawn from three separate populations, different from that of the carcass grades. The same suggestion of three populations applies also to the errors-of-estimate. A practical interpretation in less technical language might state that if it were impossible in live-grading to make errors-of estimate other than chance errors, results similar to those reported above would occur only if live-grades 2, 3, and 5 had graded one lot of animals, live-grader 1 a second lot, and live-grader 4 a third lot.

Although the aggregate analysis comparing live-graders with each other found significant differences among graders, did these differences occur in all grades of steers or was it a strong effect in just a few grades that dominated the broad analysis? Again,

analyses of variance were run on each of the eight groups of steers falling in a single carcass grade. These analyses found no significant differences among graders when they estimated animals whose carcasses fell in High Utility, low Standard, and low Good U. S. grades. Significant differences among graders did occur in the five other thirds of U. S. grades (Appendix Table 2).

Similarly for any one breed, the errors-of-estimate may differ among graders. This possibility was examined by analysis of variance, and Duncan's test when called for. Significant differences in errors-of-estimate among graders were indicated in four of the six breeds, Brahman and Charbray excepted (Appendix Table 3).

The individual live-grader.--The preceding comparisons of errors-of-estimate and actual estimates among live-graders assumed that in an individual's grading performance his errors-of-estimate were homogeneous over the several classes, breeds, and grades of cattle. While the assumption is necessary to the aggregate analysis, its realism may be challenged. Here again the quality of the data at hand falls short of the ideal, but it can be used to demonstrate a method of analysis. In the data from a controlled experiment the differences in errors-of-estimate among the various categories would be tested first. Then, if the differences among categories appeared to be non-significant, the aggregate analysis would be run on the combined observations. Otherwise, each significantly different category would be treated as a sample of a separate population of errors-of-estimate,

APPENDIX TABLE 2

ANALYSIS OF VARIANCE OF ERRORS-OF-ESTIMATE, AND THE ASSOCIATED
DUNCAN'S TEST, AMONG FIVE GRADERS, BY EACH OF EIGHT GRADES

Source	d. f.	Sum of Squares	Mean Square	Duncan's Test of Difference Among Grader's Means ^a				
High Utility								
Blocks (animals)	5	10.97	2.19					
Treatments (graders)	4	3.20	.80					
Error	20	7.20	.36					
Total	29	21.37						
Low Standard								
Blocks (animals)	10	17.78	1.78					
Treatments (graders)	4	3.01	.75					
Error	40	14.59	.36					
Total	54	35.38						
Mid Standard								
Blocks	19	93.71	4.93	4	5	1	3	2
Treatments (graders)	4	11.56	2.89**	4	5	1	3	
Error	76	39.64	.52	4	5	1		
Total	99	144.91		4	5			
High Standard								
Blocks (animals)	20	87.03	4.35	4	1	5	2	3
Treatments (graders)	4	11.47	2.87**	4	1	5	2	
Error	80	47.73	.60	4	1	5		
Total	104	146.23						
Low Good								
Blocks (animals)	13	66.34	5.10					
Treatments (graders)	4	3.95	.99					
Error	52	37.65	.72					
Total	69	107.95						

APPENDIX TABLE 2.—Continued

Source	d. f.	Sum of Squares	Mean Square	Duncan's Test of Difference Among Grader's Means ^a
Mid Good				
Blocks (animals)	29	199.13	6.87	4 1 3 2 5
Treatments (graders)	4	17.06	4.26**	4 1 3 2
Error	117	61.14	.52	4 1 3
Total	150	277.33		4 1
High Good				
Blocks (animals)	15	64.79	4.32	4 1 3 2 5
Treatments (graders)	4	15.13	3.78**	4 1 3 2
Error	60	35.27	.59	4 1 3
Total	79	115.19		
Low Choice				
Blocks (animals)	7	55.57	7.94	2
Treatments (graders)	4	9.09	2.27**	3 4 1 5
Error	28	15.31	.55	
Total	39	79.97		

**Significant at the 1 per cent level.

^aNumbers refer to the live-graders.

APPENDIX TABLE 3

ANALYSIS OF VARIANCE OF ERRORS OF ESTIMATE AND THE ASSOCIATED
DUNCAN'S TEST, AMONG FIVE GRADERS, BY EACH OF SIX BREEDS

Source	d. f.	Sum of Squares	Mean Square	Duncan's Test of Difference Among Grader's Means ^a
Herefords				
Blocks (animals)	47	261.10	5.56	4 3 <u>1</u> 5
Treatments (graders)	4	18.65	4.66**	<u>2</u>
Error	188	124.55	.66	4 3 <u>1</u>
Total	239	404.30		<u>2</u>
Brahman				
Blocks (animals)	15	68.75	4.58	
Treatments (graders)	4	19.25	.48	
Error	60	28.88	.48	
Total	79	99.55		
Charbray				
Blocks (animals)	15	58.39	3.89	
Treatments (graders)	4	5.05	1.26	
Error	60	46.55	.78	
Total	79	109.99		
Hereford x Brahman				
Blocks (animals)	15	76.80	5.12	4 1 <u>2</u> 5 3
Treatments (graders)	4	8.58	2.14*	<u>4</u> 1 <u>2</u> 5
Error	60	39.82	.66	4 <u>1</u> 2
Total	79	125.20		<u>4</u> 1
Santa Gertrudis				
Blocks (animals)	15	87.99	5.87	1 4 <u>5</u> 3 2
Treatments (graders)	4	7.88	1.97**	<u>1</u> 4 <u>5</u> 3
Error	60	21.32	.36	1 4 <u>5</u>
Total	79	117.19		<u>2</u>
Brahman x Angus				
Blocks (animals)	15	109.39	7.29	4 1 <u>3</u> 2 5
Treatments (graders)	4	6.93	1.73*	<u>4</u> <u>1</u> 3 2
Error	60	36.67	.61	4 <u>1</u> 3
Total	79	152.99		<u>4</u> 1

^aNumbers refer to the live graders.

and only the non-significantly different categories could be combined.

It might seem that for each class, breed, or grade of animal, a live grader would spawn essentially the same array of errors-of-estimate. While this relationship may be a valid assumption concerning proficient live-graders (and a desirable standard of performance), for the five live-graders observed at Belle Glade this relationship is treated as a hypothesis to be tested. If the hypothesis is true, then the errors-of-estimate associated with the several grades and classes may be pooled into one over-all sample representing a live-grader.

The data at hand contain samples of unequal size within grades, therefore, a single classification analysis of variance can be run on the distribution of errors-of-estimate made by any one live-grader. The errors-of-estimate on all animals falling in one carcass grade constitute a sample.¹⁰⁷ The simplified analysis of variance model, where a block effect cannot be isolated, becomes $d_{ij} = \mu + \alpha_i + \epsilon_{ij}$. Compared to the previous model, the random error term, ϵ_{ij} , now contains more components of an uncontrolled nature.

For a single live-grader in the group of five, the data are represented in samples of eight grades.¹⁰⁸ The eight sample variances

¹⁰⁷Since in samples of this kind, the grade value being estimated is constant, the distribution of the estimates in a sample is identical to the distribution of errors of estimate. The transformation to errors is accomplished by subtracting the constant grade value from each estimate.

¹⁰⁸A better experimental design would try to insure equal

were tested for homogeneity by Bartlett's test, and for all five graders showed non-significance. Non-homogeneity of variance would invalidate the analysis of variance.

The analysis of variance can test the hypothesis, "The errors-of-estimate made by a live-grader are the same, except for random difference, regardless of the grade of animal he observes." This analysis of variance of the performance of each live-grader indicated significant differences among grades of animals for live-graders Nos. 1, 2, 3, and 4 (Appendix Table 4). Grader No. 5 exhibited no significant differences of this sort.

A significant F-value indicates only that the mean error-of-estimate for one grade is different from the mean for one other grade. It requires a test of comparison among means, such as the Tukey or Duncan test, to locate all the differences.¹⁰⁹ The number of significant differences among mean errors-of-estimate by grades was smallest for Grader No. 4 (Appendix Table 5). In reading Appendix Table 5, be sure to examine every line of underscoring to detect all the non-sig-

numbers of animals in each grade, and have the full range of grades represented. This would allow a two-way analysis providing a better estimate of experimental error, and a more reliable test of comparisons among group means.

¹⁰⁹The difference between two items is easily grasped. When five items are considered, the problem of differences is complicated by the many possible combinations of two. Unequal sample size is a further complication. Kramer's extension of Duncan's Multiple Range Test tests the various combinations. Cf. C. Y. Kramer, "Extension of Multiple Range Test to Group Means with Unequal Number of Replications." Bio-metrics, XII (1956), pp. 307-10.

APPENDIX TABLE 4

ANALYSIS OF VARIANCE OF ERRORS-OF-ESTIMATE, AMONG
EIGHT GRADES OF ANIMALS, BY FIVE LIVE-GRADERS

Source	Degrees of Freedom	Sums of Squares	Mean Square
Live-Grader 1			
Among grades	7	36.86	5.27**
Error	118	129.99	1.10
Total	125	166.85	1
Live-Grader 2			
Among grades	7	45.85	6.55**
Error	118	201.57	1.71
Total	125	247.42	
Live-Grader 3			
Among grades	7	57.67	8.24**
Error	118	149.75	1.27
Total	125	207.42	
Live-Grader 4			
Among grades	7	48.12	6.87**
Error	118	141.59	1.20
Total	125	189.71	
Live-Grader 5			
Among grades	7	17.54	2.51
Error	118	215.96	1.83
Total	125	233.50	

**Significant at 1 per cent level of probability.

APPENDIX TABLE 5

KRAMER'S^a EXTENSION OF DUNCAN'S MULTIPLE RANGE TEST OF
SIGNIFICANCE AMONG THE MEAN ERRORS-OF-ESTIMATE FOR
EIGHT CARCASS GRADES OF 126 STEERS,
BY EACH OF FOUR GRADERS^b

GRADER 1								
Carcass Grade	(12)	(9)	(10)	(11)	(8)	(7)	(6)	(5)
Mean Error	-1.50	-1.29	-1.13	- .88	- .71	- .40	0	+ .83
GRADER 2								
Carcass Grade	(12)	(9)	(10)	(11)	(8)	(7)	(6)	(5)
Mean Error	-1.75	-1.21	- .77	- .56	- .19	- .10	- .36	+ .83
GRADER 3								
Carcass Grade	(12)	(10)	(11)	(9)	(7)	(8)	(6)	(5)
Mean Error	-2.00	- .90	- .81	- .79	- .30	0	+ .54	+ .83
GRADER 4								
Carcass Grade	(12)	(9)	(10)	(11)	(7)	(8)	(5)	(6)
Mean Error	-1.75	-1.50	-1.43	-1.25	-1.00	- .86	+ .17	+ .27

^aC. Y. Kramer, "Extension of Multiple Range Test to Group Means with Unequal Numbers of Replications," Biometrics, XII (1956), pp. 307-10.

APPENDIX TABLE 5.—Continued

^bAny two means underscored by the same line are not significantly different. Any two means not underscored by the same line are significantly different at the 5 per cent level of probability, EXCEPT if the two means are both contained in a subset of the means which has a non-significant range, the difference cannot be declared significant.

nificant differences.¹¹⁰

For any one live-grader his errors-of-estimate may differ among breeds. Analysis of variance and the associated Duncan's test indicated significant differences in errors-of-estimate among breeds only for Graders Nos. 3 and 4 (Appendix Table 6).

On a group of animals in one carcass grade, the difference between the live-grader's mean estimate and the carcass grade is also an estimate of bias. In this respect, the hypothesis of no difference among mean errors-of-estimate could be stated as no difference in biases among grades. While two or more biases may be significantly different from each other, it is possible that one or more of them may not be significantly different from zero. There are eight estimates of bias, one for each grade, available from the scores of each grader. Could these eight mean errors-of-estimate all have come from sampling distributions of mean errors normally distributed with mean zero? The hypothesis to test is $\mu = 0$. Expressing the bias as \bar{d} , the hypothesis is tested by computing for each \bar{d} :

$$(7) \quad t = \frac{\bar{d} - \mu}{s_{\bar{d}}} = \frac{\bar{d} - 0}{s_{\bar{d}}}, \text{ where } s_{\bar{d}} = \frac{s_d}{n}$$

¹¹⁰For instance, with Grader No. 1, his mean error for grade 5 is not different from grades 7-12. His grade 6 is not different from either 5, 7, 8, or 11, but is different from 9, 10, and 12. It may require practice for some readers to become accustomed to this type of table, but there is no more concise way of presenting these results in summary form.

APPENDIX TABLE 6

ANALYSES OF VARIANCE OF ERRORS-OF-ESTIMATE AND ASSOCIATED
DUNCAN'S TEST,^a AMONG SIX BREEDS OF ANIMALS,
FOR TWO LIVE-GRADERS

Source	d. f.	Sum of Squares	Mean Square	Duncan's Test (Kramer's Extension) of Differences Among Grader's Means
Live Grader 3				
Breeds	5	30.13	6.03**	1 6 <u>3^d</u> 2 <u>4^{b,c}</u> 5
Error	122	185.86	1.52	1 6 <u>3^d</u> 2 5
Total	127	215.99		
Live Grader 4				
Breeds	5	28.26	5.65**	6 1 <u>5</u> <u>3</u> <u>2</u> <u>4</u>
Errors	122	166.36	1.36	<u>6</u> 1 <u>5</u> <u>3</u> <u>2</u>
Total	127	194.62		<u>6</u> 1 <u>5</u> <u>3</u>

**Significant at the 1 per cent level.

^aD. B. Duncan, op. cit.

^bAny two means underscoring by the same line are not significantly different. Any two means not underscoring by the same line are significantly different at the 5 per cent level of probability, EXCEPT if the two means are both contained in a subset of the means which has a non-significant range, the difference cannot be declared significant.

^cThe numbers refer to breeds: 1—Hereford; 2—Brahman; 3—Charbray; 4—Braford; 5—Santa Gertrudis; 6—Brangus.

^dThe mean error was the same for breeds 3 and 5.

The variances of each set of eight distributions from which the \bar{d} 's are computed can be tested for homogeneity by Bartlett's test. If found homogeneous, all eight are pooled as an estimate of σ_d^2 . For the eight distributions of each grader the pooled estimate of σ_d^2 is obtained in the analysis of variance as the error component, s_d^2 .

On the basis of the t-test results (Appendix Table 7) there appears to be, for the five graders, a tendency for the mean errors-of-estimate or bias on the lower grades of animals to be essentially zero. In estimating the grades of the higher grades of animals, the occurrence of definite biases appears very likely.

The analysis of variance (Appendix Table 4) produced evidence supporting non-acceptance of the hypothesis of similar errors-of-estimate among all grades regarding live-graders Nos. 1, 2, 3, and 4. This hypothesis could not be rejected in regard to Grader No. 5. Although Grader No. 5 is an exception, it should be clear from this evidence that for any of the four graders, there is no justification for combining his errors-of-estimate over all grades and computing an over-all bias. Apparently, the means of several separate populations of errors-of-estimate are involved.¹¹¹

Some of the avenues of approach to inferential analysis of grading performance have been presented in this chapter. Because the

¹¹¹But, by assumption in the analysis of variance and supported by Bartlett's test, the variances of the several separate populations representing grades are homogeneous.

APPENDIX TABLE 7

VALUES OF t FROM THE TEST OF $\mu = 0$ USING THE
MEAN ERROR-OF-ESTIMATE, BY EACH GRADER,
FOR ALL ANIMALS IN A SPECIFIED
CARCASS GRADE^a

GRADE	n-1 d. f.	GRADER				
		1	2	3	4	5
High Utility	(5)	1.94	1.94	1.94	.40	.40
Low Standard	(10)	0	1.14	1.71	.85	.28
Mid Standard	(19)	1.71	.43	1.28	4.27**	3.63**
High Standard	(20)	3.10**	.83	0	3.76**	2.92**
Low Good	(13)	4.61**	4.32**	2.82*	5.36**	3.82**
Mid Good	(29)	5.92**	4.03**	4.71**	7.49**	2.25*
High Good	(15)	3.36**	2.14	3.09*	4.77**	.23
Low Choice	(7)	4.04**	4.72**	5.39**	4.72**	1.67

*Significant at 5 per cent, but not 1 per cent.

**Significant at 1 per cent.

$$^a_t = \frac{\bar{d} - \mu}{s_{\bar{d}}} = \frac{\bar{d} - 0}{s_{\bar{d}}}$$

data were not strictly from random samples or a designed experiment, the validity of the particular differences showing significance here is not predictable. This, however, was recognized at the outset of the analysis. Nevertheless, the technique has great potential in evaluating objectively the differences among grading abilities of individuals.

BIBLIOGRAPHY

- American Meat Institute. Financial Facts About the Meat Packing Industry. Chicago: American Meat Institute, 1958.
- Blodgett, R. H. Our Expanding Economy. New York: Rinehart and Co., 1955.
- Breimeyer, H. F. "Price Determination and Aggregate Price Theory," Journal of Farm Economics, August, 1957, pp. 676-94.
- Castle, H. L. "The Direct Marketing of Livestock in Florida." Unpublished Master's dissertation, Department of Agricultural Economics, University of Florida, 1956, p. 74.
- Clifton, E. S. Pricing Accuracy of Slaughter Cattle, Veal Calves, and Lambs. Indiana Agricultural Experiment Station Bulletin No. 611. Lafayette: Purdue University, 1954.
- Dowell, A. A., et al. Marketing Slaughter Cattle by Carcass Weight and Grade. Minnesota Agricultural Experiment Station. Technical Bulletin No. 181. Minneapolis: University of Minnesota, 1949.
- Duncan, D. B. "Multiple Range and Multiple F. Tests," Biometrics, XII (1955), pp. 1-42.
- Engelman, Gerald, et al. Relative Accuracy of Pricing Butcher Hogs on Foot and by Carcass Weight and Grade. Minnesota Agricultural Experiment Station. Technical Bulletin No. 208. Minneapolis: University of Minnesota, 1953.
- Florida Department of Agriculture. U. S. Department of Agriculture. Florida Weekly Livestock Market Summary. Vols. XXXX and XLI. Thomasville, Georgia: U. S. Department of Agriculture, 1957, 1958.
- Florida State Marketing Bureau. Annual Agricultural Statistical Summary. Jacksonville 1: Florida State Marketing Bureau, 1957 and 1958.
- Halcrow, H. G. Agricultural Policy of the United States. New York City: Prentice-Hall, Inc., 1953.
- Heady, E. O. Economics of Agricultural Production and Resource Use. New York City: Prentice-Hall, Inc., 1953.

- Jebe, E. H. and Clifton, E. S. "Estimating Yields and Grades of Slaughter Steers and Heifers," *Journal of Farm Economics*, May, 1956, pp. 584-96.
- Kramer, C. Y. "Extension of Multiple Range Test of Group Means with Unequal Number of Replications," *Biometrics*, XII (1956), pp. 307-10.
- Marshall, Alfred. *Principles of Economics*. 8th ed. New York: The MacMillan Co., 1921.
- Mills, F. C. *Statistical Methods*. 3rd ed. New York: Henry Holt and Co., 1955.
- McPherson, W. K. "Initial Results of Livestock Marketing Study," *The Florida Cattleman* (September, 1952).
- _____. "How Well Do Auctions Discover the Price of Cattle?", *Journal of Farm Economics*, February, 1956, pp. 30-43.
- McPherson, W. K., et al. "An Economic and Statistical Analysis of Grading Cattle." Florida Agricultural Experiment Station. Gainesville: University of Florida, 1959, p. 80 (bulletin manuscript).
- Naive, J. J., et al. *Accuracy of Estimating Live Grades and Dressing Percentages of Slaughter Hogs*. Indiana Agricultural Experiment Station Bulletin No. 650. Lafayette: Purdue University, 1957.
- Nichols, W. H. *Imperfect Competition within Agricultural Industries*. Ames, Iowa: The Iowa State College Press, 1941.
- Ostle, Bernard. *Statistics in Research*. Ames, Iowa: Iowa State College Press, 1954.
- Phillips, C. D., and Pearson, James L. *Accuracy of the Present Methods in Pricing Veal Calves, Slaughter Cows, and Lambs*. Kentucky Agricultural Experiment Station Bulletins Nos. 610, 611, and 612. Lexington: University of Kentucky, 1954.
- Shepherd, G. S. *Marketing Farm Products*. Ames, Iowa: Iowa State College Press, 1947.
- _____. "What Can a Research Man Do in Agricultural Price Policy?", *Journal of Farm Economics*, May, 1955, pp. 305-14.

Snedecor, G. W. Statistical Methods. 5th ed. Ames, Iowa: The Iowa State College Press, 1956.

U. S. Department of Agriculture. Consumption Patterns for Meat. AMS-249. Washington: Government Printing Office, May, 1958.

_____ The Livestock and Meat Situation. LMS-99. Washington: Government Printing Office, November, 1958.

_____ The Marketing and Transportation Situation. Washington: Government Printing Office, 1953 - 1959.

_____ Foreign Agricultural Circular. FLM 11-58. Washington: Government Printing Office, October, 1958.

_____ Soil, The 1957 Yearbook of Agriculture. Washington: Government Printing Office, 1957.

_____ Livestock and Meat Statistics. Statistical Bulletin No. 230. Washington: Government Printing Office, 1958.

_____ Beef Marketing Margins and Costs. Miscellaneous Publication No. 710. Washington: Government Printing Office, 1956.

_____ Marketing Margins for Beef. Washington: Government Printing Office, 1953.

_____ Meat Animals, Farm Production, Disposition, and Income. Washington: Government Printing Office, 1924-57.

U. S. Department of Commerce. Bureau of the Census. United States Census of Agriculture: 1954. Vol. I, part 18. Washington: Government Printing Office, 1955.

Waugh, F. V. Readings in Agricultural Marketing. Ames, Iowa: The Iowa State College Press, 1954.

Webb, John N. Preliminary Estimates of the Population of Florida Counties: July 1, 1957. Bureau of Economic and Business Research. Population Series Bulletin No. 4. Gainesville: University of Florida, 1958, p. 4 (mimeographed).

Webster's New Collegiate Dictionary. Springfield, Massachusetts: G.&C. Merriam Co., 1953.

Williams, W. F. "Structural Changes in the Meat Wholesaling Industry," Journal of Farm Economics, May, 1958, pp. 315-29.

-
- Wholesale Meat Distribution in the San Francisco Bay Area.
U. S. Department of Agriculture Marketing Research Report No.
165. Washington: Government Printing Office, 1957.
- Williams, W. F., et al. Economic Effects of U. S. Grades for Beef.
U. S. Department of Agriculture Marketing Research Report No.
298. Washington: Government Printing Office, 1959.
- Williamson, H. F. (ed.). The Growth of the American Economy. New
York: Prentice-Hall, Inc., 1946.

BIOGRAPHICAL SKETCH

Louis Vernon Dixon was born in California, Missouri, January 17, 1927. He enrolled at the University of Connecticut in June, 1944. Following a period of military service, he completed the requirements for the Bachelor of Science degree in January, 1950. He entered graduate school at the University of Connecticut in September, 1953, after working with the United States Department of Agriculture, and another period of military service. He was awarded the Master of Science degree in June, 1955.

He has been employed as a soil conservationist by the U. S. Department of Agriculture, and as a research assistant at the Connecticut and Florida Agricultural Experiment Stations. Since July, 1957, he has been employed as an agricultural economist with the United States Department of Agriculture. The analysis and conclusions in the dissertation represent only the opinions of the writer and not those of the Department of Agriculture.

He is a member of Gamma Sigma Delta and Phi Kappa Phi honor societies, and the American Farm Economic Association. He was awarded a Charles H. Hood Dairy Foundation fellowship in 1955 and 1956.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of the committee. It was submitted to the Dean of the College of Agriculture and to the Graduate Council and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

June 8, 1959

S. H. Houston
and Dean, College of Agriculture

Dean, Graduate School

SUPERVISORY COMMITTEE:

W. K. McPherson
Chairman

H. H. Hamilton

John W. DeShave

J. R. Greenman

R. H. Blodgett

281.343

D619P

AGRI-
CULTURAL
LIBRARY

UNIVERSITY OF FLORIDA



3 1262 08554 2966